cirad

AGRICULTURAL RESEARCH
FOR DEVELOPMENT

Annual Report 2014 : Results and prospects


rural
climate
development
change
plants
territories
animals
public policy
societies
production
biodiversity
chains
genome
agro-ecology
forests
ecosystems
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farming
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local know-how
emerging
landscape
diseases

Foreword from Michel Eddi, CIRAD President Managing Director


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The United Nations declared 2014 "International Year of Family Farming". CIRAD could not have dreamt of a better opportunity to contribute to the discussions, deliberations and debates around the globe on this topic of vital importance for the future of agriculture worldwide. Under the aegis of the Ministries in charge of agriculture and development, we have taken this chance to publicize the results of our research and the expertise built up over the decades on an issue that remains central to the future of farming systems in both North and South. Improving production and living conditions for family farms is one of our main priorities, so we naturally chose family farming as our theme for the year.

We did our utmost to take part in every possible debate and discussion during the many events held throughout this action-packed year.

• An international meeting on the topic of "Family farming and research", organized in Montpellier by Agropolis International, GFAR, the CGIAR and the FRM.

• Quality interactive exchanges with members of the general public, who are hugely concerned by this topic, at the Paris International Agricultural Show. The interest shown reflects the concerns and expectations of large numbers of people as regards the future and ability to adapt of farming systems and their ages-old structure, in both North and South, in the light of the new challenges faced.

• The success of our travelling exhibition on the topic, produced with the AFD, the Institut français and the IRD.

• A range of publications on the many aspects of the debate, to which our colleagues have contributed throughout the year and which culminated in the publication of the collaborative work "Family Farming and the Worlds to Come", which sets out to summarize no less than three decades of research on the topic.

What great opportunities for CIRAD to boost its reputation and notoriety!

Despite certain restrictions and other difficulties, 2014 has also brought other high spots, other results and other reasons to believe in the future.

In no particular order:

– the signing of a new set of contractual objectives with the State, within a climate of continued confidence;

– the adoption by the Board of Trustees of our "Scientific and Partnership Strategy Objectives" (SPSOs, or OSSP in French) and the contractualization of our shared objectives for the next five years with our research units;

– the launch of our economic efficiency drive, which has confirmed out structural capacity to adapt by mobilizing our personnel;

– the consolidation of our partnerships, through the structuring and confirmation of our research facilities;

– the renewal of our links with countries such as Ivory Coast, which are such a vital part of our shared history;

– new initiatives for Africa, such as "ProIntens-Africa", which has been accepted by the European Commission;

– joint scientific initiatives with INRA in favour of the agro-ecology concept supported by the Minister of Agriculture or those concerning the adaptation of agriculture in response to climate change;

– the success of technical innovation and agricultural transfer networks (RITAs) in the French overseas regions, which has led on to the second phase of the programme;

– the launch of the Regional Platform for Agricultural Research for Development in the Indian Ocean (PReRAd);

– and many fine results from our research!

2014… a productive, positive year for CIRAD.

I should like to thank everyone—staff members, partners, associates and ministerial staff—who through their support, work and unflinching support for our values, have made all this possible!

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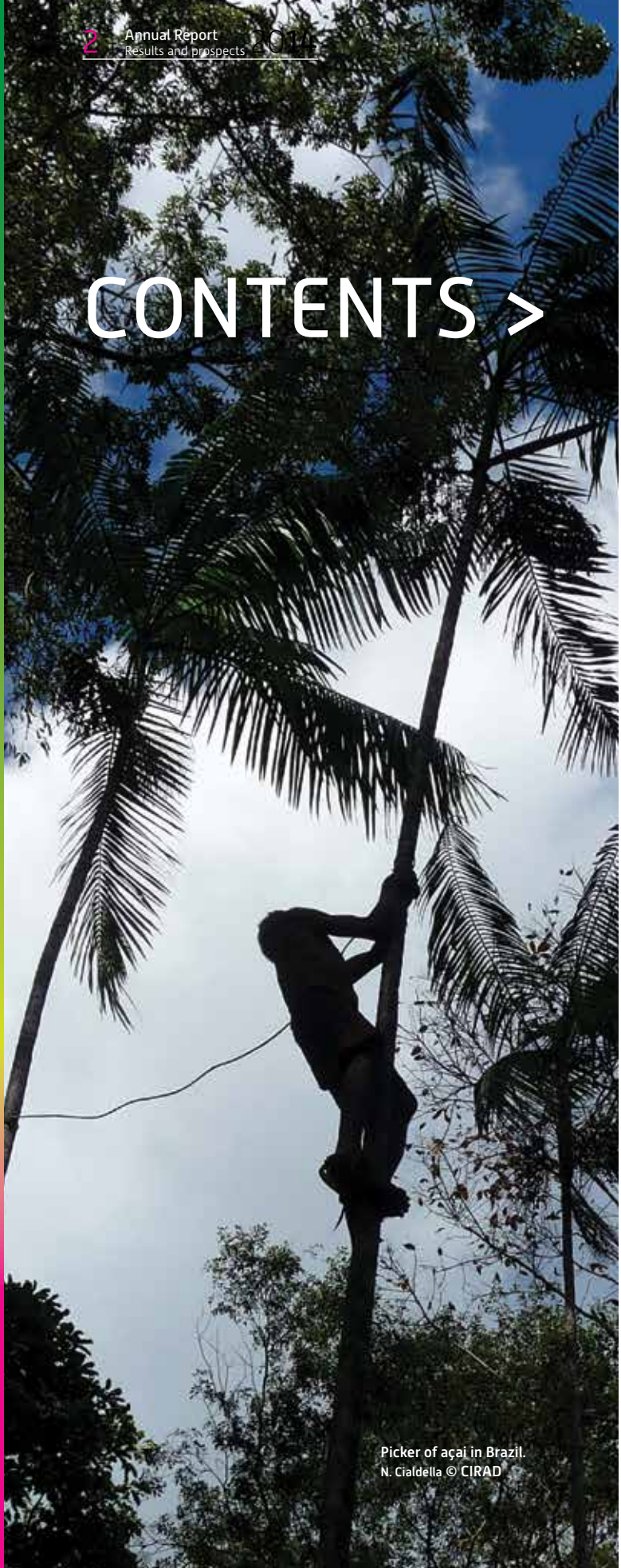

Picker of açai in Brazil.
N. Cialdella © CIRAD

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CIRAD is the French agricultural research and international cooperation organization working for the sustainable development of tropical and Mediterranean regions

CIRAD's recognized expertise in agricultural issues in the South makes it a European reference in global scientific networks.

Its scientific operations respond to the needs of local populations and the main issues facing agriculture worldwide.

CIRAD is a targeted research organization that sees partnership as one of the cornerstones of its scientific strategy.

Working together for tomorrow's agriculture

> The men and women working at CIRAD come up with novel solutions tailored to the needs of rural societies and their environment.

> Partnership is both a means and an end for them.

> These men and women are committed to building sustainable farming systems capable of feeding 9 billion human beings by 2050.

CIRAD

1650 staff members

A budget of
€ 200M in 2014

1st agricultural research player
in the French overseas regions

TRAINING

5 400 hours of teaching each year

300 PhD students supervised each year,
including **200** from southern countries

A partner in **120** higher education courses
(Masters to PhDs) in France and abroad

PARTNERSHIP

400 researchers assigned abroad

19 000 days of missions/year

Activities in more than **100** countries,
in partnership with **150** organizations

RESEARCH

800 journal articles per year,
including **400** co-publications with
researchers from partner countries

800 researchers and technicians from
all over the world received each year

More than **20** research and training platforms
in partnership worldwide

Mamoudzou market, Mayotte
L. Balberini © CIRAD

INSTITUTIONAL HIGHLIGHTS >

EVOLVING IN ORDER TO ACHIEVE OUR AMBITIONS

Sustainable development CIRAD's commitment

The goal of CIRAD, a targeted research organisation, is to contribute to the long-term viability of societies and ecosystems, with special attention to the situation of the poorest people. It strives to set an example in its own practices and their impacts. In September, CIRAD therefore sent an even stronger message about its commitment to this vision when it signed the Sustainable Development Charter for Public Establishments and Enterprises, going beyond the minimum legal requirements.

By signing this charter, CIRAD shares the values and principles for sustainable development action with 61 establishments. It has translated these into quality approaches and continuous improvement in its management systems and activities. CIRAD takes responsibility for this process, spearheaded by the Office of the Director-General, but also developed by all CIRAD staff members. It will report regularly to the Board of Trustees and will propose a strategic plan setting priorities according to the resources available.

CIRAD will also take part in the exchange of good practice, especially during the peer information-sharing meetings organised and conducted within the framework of the Club Développement Durable des Établissements Publics et Entreprises Publiques.

leandre.mas@cirad.fr
Coordinator for Quality and Sustainable Development

CIRAD IS ALREADY DEVELOPING A SOCIALLY AND ECOLOGICALLY RESPONSIBLE APPROACH TO ITS ACTIVITIES

Responsible management or eco-responsibility for activities is reflected in the procedures for different actions: energy efficiency; waste management; and procurement, equipment and consumption. It is based on recognised standards such as the quality approach and environmental management (three carbon audits have been carried out).

Two sites (Montpellier and Martinique) have already developed an environmental action plan and a monitoring mechanism, in particular for greenhouse gas emissions reductions. All six CIRAD sites should have these by 2017.

Human resource management strives to respect diversity (gender equity, disability management, older workers, etc.), to prevent occupational stress and to develop employees skills.

Constructive relationships are being forged with local authorities (in metropolitan and overseas France). In particular, the knowledge and know-how produced by CIRAD is used to assist citizens and policy makers in making informed, responsible decisions: waste recycling in Réunion; environment and management of chlordecone in the French West Indies; and enhancing and protecting biodiversity and fragile ecosystems, etc.

M. Adell © CIRAD

François Pouget, new Director General in Charge of Resources

François Pouget, a 33 year old economist, was appointed the new Director General in charge of Resources and Organisation at CIRAD on 2 June. Previously, he worked at the French Ministry of Finance and Public Accounts. He also sat on the CIRAD Board of Trustees, representing the Minister for the Budget.

The office he will be heading at CIRAD encompasses all of its logistical services. François Pouget's main task is to oversee implementation of the establishment's strategy and contractual objectives in the field of research support. He will also manage social relations within the establishment, chair the works council, and steer a major project to develop CIRAD's own resources, the Resource Development Pact.

New Contractual Objectives signed with the supervisory ministries

The 2014-2018 Contractual Objectives have been signed between CIRAD and its supervisory ministries.They set out the priority goals, shared with the state, for **the four ambitions** CIRAD has established for its strategy over the next 10 years.

This contract commits CIRAD to actively participating in the national research strategy and to developing its partnerships with southern countries within the framework of coordinated international agricultural research. It also prioritises a certain number of processes to modernise operations within the establishment. The goal is to consolidate CIRAD's economic model by renewing its contract portfolio in line with its scientific and partnership strategy. CIRAD is in a good position to exploit its comparative advantages, linked to its recognised capacity for cooperation between northern and southern countries. Michel Eddi, CIRAD's President, the French Minister Laurent Fabius (Foreign Affairs and International Development), and the Secretaries of State Annick Girardin (Development and French-Speaking Countries) and Geneviève Fioraso (Higher Education and Research) signed the document.

Serving as a global reference for our scientific priorities.

Co-building strategic agricultural research for development partnerships.

Establishing the conditions for effective innovation.

Evolving in order to achieve our ambitions.

Research and training platforms in partnership (RPPs)

The research and training platforms in partnership (RPPs) are the most accomplished – but not the only – mechanism developed by CIRAD in order to build long-term partnerships with institutions in the southern countries around shared issues.

In order to promote the 21 RPPs among donors, CIRAD has produced a set of documents highlighting their expertise and strengths, and the networks in which they are involved. Paintings have been produced by local artists to evoke the issues addressed by these RPPs, marking their scientific and cultural identity. These paintings are exhibited in the entrance hall at the Montpellier research centre.

Within the framework of its RPPs, CIRAD fosters contractual partnerships based on proximity (156 partner organisations in 2014), but also partnerships between platforms. These partnerships are open to all stakeholders concerned by innovation in agriculture, food and environment. The long-term objective is to gain recognition for RPPs as partnership platforms in the southern countries, on the same basis as other French mechanisms, especially through the Alliance Nationale de Recherche pour l'Environnement, AllEnvi.

In its international strategy document, the board of Agreenium, of which CIRAD is a member, stressed that the RPPs must be considered by all Agreenium members as priority investment areas in developing countries.

jacques.pages@cirad.fr
Coordinator, Platforms in Partnership for Research and Training

Painting produced
for Malica RPP
© Tran Thanh Hang

A five-year plan for the research units

Each of CIRAD's research units was evaluated by the Agence d'Evaluation de la Recherche et de l'Enseignement Supérieur (AERES). The development of a scientific trajectory contributing to the completion of projects under the "Objectifs de Stratégie Scientifique et Partenariale" (OSSP - scientific and partnership strategy objectives) is provided for in the 2014-2018 Contractual Objectives. This process will involve three types of steering: steering "by conviction", based on the internal debate, which encourages the appropriation of strategic priorities; the "incentive" approach, through the allocation of targeted financial resources; and "contract-based objectives", through the "Lettres annuelles d'objectifs" (LAO - annual objectives letters) within the framework of the establishment's annual budget, for both research units and support services.

The research units' scientific projects and their implementation will also be formalised by contract for a duration of five years in the form of a "Lettre pluriannuelle d'objectifs" (LPO - multi-year objectives letter), thereby supplementing the mechanism established with the LAOs.

The LPO ensures coherence between the strategies of the research units and of the establishment, in particular for the three main areas: the priority lines of research, the establishment's **TWO THEMATIC INITIATIVES**, and the research and training platforms in partnership (RPPs).

TWO THEMATIC INITIATIVES

Establishing the conditions for effective innovation

INNOVATION AND IMPACT

How and through which channels do research findings generate or contribute, through innovation, to development in rural southern societies? How can this impact be qualified and quantified in CIRAD's strategy? For its first year, the working group responsible for this initiative selected 13 case studies representing the whole range of CIRAD's actions. It organised a workshop in October with researchers involved in these case studies and external experts to validate and improve the methodological framework for its expertise.

The five-year objective for the "Innovation and impact" initiative is to develop a methodology and process for assessing the impact of CIRAD research, both internally and for supervisory ministries and donors, based on case studies. The initiative has four components: setting up a methodology platform; exploring the range of innovations and their impacts; building research capacities on the linkages between innovation and impact; and developing a "culture of impact".

etienne.hainzelin@cirad.fr
danielle.barret@cirad.fr
Coordinators for the "Innovation and Impact" initiative

Female *Hypothenemus hampei*, coffee borer beetle. © CIRAD

Promoting the ambition of scientific integration for sustainable development

SUPPLY CHAINS AND SUSTAINABLE DEVELOPMENT

How can the requirements of both production and sustainable development be met? In many tropical countries, a small number of agricultural sectors play a major economic and social role. However, the increase in world production raises fears of resource depletion and major global imbalances. From this perspective, technical and biological approaches to agri-food systems need to be thoroughly restructured.

CIRAD has some key strengths in terms of tropical supply chains, with its considerable knowledge, remarkable results and databases, world-renowned expertise and robust, long-term connections with numerous public and private sector partners. Its thorough understanding of the biological models, operating systems and organisational structures of supply chains in different countries give it credibility with its partners and scientific and social importance. The processes launched for oil palms and banana trees in particular are promising, and carry some valuable lessons for the promotion of new approaches.

The "Supply chains and sustainable development" initiative, which will launch in 2016, will be organised around four components: scientific activities and the sharing of methodologies; integrated scientific output; expertise and foresight; and decision support for engagement with private operators.

estelle.bienabe@cirad.fr
Office of the Director General in charge of Research and Strategy
hubert.omont@cirad.fr
Coordinator for Tropical Supply Chains

Industrial plant nursery, Congo. . © D. Louppe/CIRAD

Digital heritage

Promoting 60 years of research

In the digital era, new methods of scientific data collection (shared platforms, participatory research, etc.), analysis (data mining and data science) and knowledge dissemination (data associated with publications) are paving the way for open science. In addition, integration of the major global challenges (climate change, pressure on ecosystems, etc.) is prompting researchers to take a fresh look at old data that could be reused and associated with new data to study certain dynamics. This raises the question of data sharing within different user groups.

Aware of these challenges, CIRAD has initiated a process of external intelligence and discussions with its research unit partners (INRA, IRD, etc.). An initiative has been launched on CIRAD's digital heritage, focusing primarily on scientific data. A working group has thus been set up to report on the organisation's latest developments and practices. It is also expected to propose a plan of action and to produce recommendations. All organisational levels are involved (departments and pilots research units, support services, human resources, ethics and deontology, etc.).

Certain data resulting from more than 60 years of research in tropical regions could therefore be re-examined. The data obtained from new projects will benefit from new management plans enabling them to be reused.

pascal.bonnet@cirad.fr
Environments and Societies Department (ES)

Planting out manioc cuttings in Madagascar.
© CIRAD. Support: glass plate

© CIRAD

ARCHIWOOD PROJECT

CIRAD's xylotheque constitutes one of the largest collections of tropical wood recognised at the international level. The ArchiWood project, supported by the Bibliothèque Scientifique Numérique (BSN) and the French Ministry of Research, will enable the digitisation of a specific part of this collection: tree species from the island of Madagascar. This island boasts a remarkable diversity of flora, with a very high rate of endemism, making it a permanent laboratory for studying the mechanisms that govern evolution. **This project was chosen among a number of proposals for its scientific originality.**

loic.brancheriau@cirad.fr
Biomass, Wood, Energy, Bioproducts (BioWooEB research unit)

DEVELOPING AND STRENGTHENING STRATEGIC PARTNERSHIPS

Food security
The CIRAD-INRA metaprogramme

Feeding 10 billion human beings by 2050 in a sustainable, healthy and equitable way.

Faced with this challenge, CIRAD, INRA and their partners in France decided to take a fresh look at this issue and to develop a joint programme. The seminar to launch the GloFoods metaprogramme (Transitions to global food security) took place in June in Montpellier, with 140 participants from research and education. In July, some of the participants continued their discussions during the international meeting on the governance of food security organised by FAO and IDDRI. A call for expressions of interest was published in December. It will provide incentive funds for teams involved in innovative projects.

etienne.hainzelin@cirad.fr Co-director of Glofoods

Market in Nicaragua. S. Fréguin © CIRAD

Europe. New initiatives for Africa

CIRAD, a stakeholder in the Europe-Africa dialogue on research and innovation. Following the 4th EU-Africa Summit in Brussels in April, a group of 10 experts was tasked by the European Commission and the African Union Commission with preparing a roadmap for a partnership in the food and nutrition security and sustainable agriculture sectors. CIRAD, represented by Philippe Petithuguenin, co-chairs this group, which is part of the EU-Africa High Level Policy Dialogue (HLPD) on science, technology and innovation. This roadmap is the subject of broad consultations. It advocates developing the EU-Africa partnership around three thematic pillars: sustainable intensification; agricultural and food systems for nutrition; and expansion and improvement of agricultural markets and trade. There are also cross-cutting pillars: adding value to existing partnerships; facilitating innovation processes; capacity building for research and innovation; and implementing adaptive governance. The roadmap is expected to be adopted in 2015.

The "IntensAfrica" initiative supported within the framework of the Horizon 2020 programme. The ProIntensAfrica project was accepted by the European Commission in November. The aim of this original proposal is to validate over two years the feasibility of joint research programming on a large scale between Europe and Africa. It will help to advance the IntensAfrica initiative, led by CIRAD and Wageningen University since 2013. This initiative brings together scientific partners from 13 European countries and a number of African countries belonging to the Forum for Agricultural Research in Africa (FARA) around a shared ambition: the sustainable intensification of agri-food production systems.

A new annual meeting with policy makers. CIRAD has launched "See you in Brussels!", a series of annual conferences held in Brussels. Its goal is to enable regular discussions with policy makers as a major partner of research, cooperation and regional support policies. The first edition was held on 2 December at the Maison de la Région Languedoc-Roussillon, and was attended by Michel Eddi, Patrick Caron and Philippe Petithuguenin. Jean-Michel Sourisseau and Pierre-Marie Bosc for CIRAD, and José Antonio Osaba for the World Rural Forum, presented an overview of the International Year of Family Farming, and especially of CIRAD's work, to around 50 leading figures and policy makers from the European Commission, the European Parliament and the Secretariat of the African, Caribbean and Pacific Group of States, as well as ambassadors to the EU from the southern countries.

jean-michel.sers@cirad.fr
Europe Officer

CIRAD joins the Global Alliance for Climate-Smart Agriculture

Fifteen months ahead of the Conference of the Parties on climate change in Paris in December 2015 (COP21), the Secretary-General of the United Nations, Ban Ki-moon, convened a summit for the climate on 23 September in New York. The Global Alliance for Climate-Smart Agriculture was launched on this occasion. Its goal is to improve agricultural productivity and livelihoods for 500 million farmers throughout the world, to increase food system resilience and to reduce greenhouse gas emissions associated with agriculture. The Alliance is organised around three pillars: building knowledge and sharing information; mobilising public and private finance and increasing its effectiveness; and creating an enabling policy environment.

The charter was signed for France by Annick Girardin, Secretary of State for Development and French-speaking Countries. Ms Girardin reiterated that the French government is committed to promoting climate-smart agriculture based on an agroecological approach and building on the family farming model, at both the national and international levels. Michel Eddi also signed CIRAD's accession to this charter according to the lines presented by Annick Girardin.


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Annick Girardin (left) and Michel Eddi (right).

emmanuel.torquebiau@cirad.fr
Climate Change Officer

The France-FAO symposium on agro-ecology

Stéphane Le Foll, Minister for Agriculture, Food and Forestry, on the podium

The International Symposium on Agro-ecology for Food and Nutrition Security, held in September in Rome (Italy), is a joint initiative by FAO and the French Ministry of Agriculture. CIRAD was co-organiser and sponsor of this symposium alongside FAO and INRA. The aim of this event was to promote a dialogue with a view to gathering existing agro-ecology experiences and policies. Its originality is that it brought together scientists, NGOs and private and public stakeholders. The symposium attracted 400 participants from 61 countries, and received coverage from more than 60 media organisations from around the world. CIRAD was actively involved in the scientific organisation of this event, with three introductory conferences, round tables and numerous posters.

A delegation of eight people accompanied Stéphane le Foll, French Minister for Agriculture, Food and Forestry, who particularly promoted the French "agroecological project". The Minister also supported the three regional meetings proposed for the future, with the possibility of hosting one of them in Paris in 2016. In addition, France offered to support the creation of a "Club of agro-ecology-friendly countries", and the sharing of scientific information and locally adapted practices.

After the conference, Jacques Pagès, Representative of France to FAO, brought together the CIRAD scientists present and Barbara Herren, Chair of the scientific committee for the symposium, in order to plan specific action in the field associating FAO and certain of


© MAAF

CIRAD's research and training platforms in partnership (RPPs). Among the different collaborations envisaged, scientific knowledge building among FAO representatives and the organisation of Farmers Field Schools were discussed.

etienne.hainzelin@cirad.fr
Adviser to the Director

Final report of the symposium:
http://www.fao.org/about/meetings/afns/fr

The agroecological project in France:
http://agriculture.gouv.fr/agroecologie-une-force-pour-la-france

Strengthening partnerships with ACP countries

The first formal framework agreement between CIRAD and the Secretariat of the African, Caribbean and Pacific Group of States (ACP) was signed on 9 December in Brussels. CIRAD is already working very closely with a number of institutions in ACP countries. On 8 April, the centre in Montpellier welcomed several ambassadors and representatives from ACP sugar-producing countries. During this visit, Michel Eddi and Patrick Gomes, Chair of the ACP Sub-Committee and Ambassador of Guyana, renewed their agreement on scientific and technical collaboration for agricultural issues such as biofuels, biomaterials, social approaches to production and ecological intensification. The agreement was signed during the 100th meeting of the Council of Ministers of the ACP Group in Brussels. Philippe Petithuguenin, Deputy Director General in charge of Research and Strategy, represented CIRAD at this meeting.

philippe.petithuguenin@cirad.fr
Office of the Director General in charge of Research and Strategy

Philippe Petithuguenin and Alhaji Muhammad Mumuni, Secretary General of the ACP Group, in Brussels © J.-C. Dagallier/CIRAD

The success of the innovation and agricultural transfer networks (RITAs)

Renewal of the agreement between the Ministry of Agriculture, CIRAD and ACTA © S. Della Mussia/CIRAD

The first implementation phase of the Innovation and Agricultural Transfer Networks (RITA 1) ended in late 2014. These networks were appraised during different national events, such as the seminar organised by ACTA, CIRAD and ODEADOM at the Paris International Agricultural Show, and during regional events, including the seminar on 9 December in Martinique. Project appraisals were also made, for example for Eva-transfert in Guadeloupe on 25 November. These appraisals highlight the efficiency of this multi-partner initiative led by ACTA and CIRAD and implemented in late 2011 by the French Ministry of Agriculture in order to diversify and promote livestock and crop production in the French overseas regions.

From RITA 1...

Evaluating and certifying new plant varieties (yams, bananas, pineapples, citrus fruits, mammees, herbs and medicinal plants, etc.), implementing new fruit and vegetable crop systems with a low level of chemical inputs, improving cattle, pig and rabbit production, and also better understanding bees and their products, etc. Whether in Réunion, Mayotte, Guadeloupe, Martinique or French Guiana, after just two years, the first wave projects (RITA 1) are already producing tangible results.

Operating as a network has made it possible to involve all stakeholders, from research to agricultural development and training. Innovations have been developed with producers in order to improve the economic and environmental sustainability of production. The RITA networks are therefore held up as examples of effective multi-partner initiatives. They are well positioned to benefit from the new European, national and regional development programmes.

… to RITA 2

The common goal, with RITA 2 (2015-2020), is to develop new agroecological practices with as many farmers as possible. In 2015, new projects will be launched. In Guadeloupe, the RITA will integrate stakeholders from the cane sugar sector. In Martinique, food processing and agroforestry projects will be included. Livestock performances and quality improvement for animal products will be a flagship project in Mayotte. In French Guiana, tuber crops and slash and burn farming will be integrated. In Réunion, the field of action will also be extended with the inclusion of sugarcane and the livestock sector.

The French Ministry of Agriculture has renewed the mandate for CIRAD and ACTA. These organisations will continue to operate in a similar way, focusing on outreach and information sharing between the French overseas departments. Knowledge transfer and training will be developed with the Chambers of Agriculture, agricultural technicians and agricultural trainers. A forward-looking debate will be conducted on the future of the RITA networks in order to find the resources required to pursue initiatives for producers in the French overseas departments.

jean-marc.thevenin@cirad.fr
Pests and Diseases: Risk Analysis and Control (Pests research unit)

Field visit in Martinique: cover plants in banana plantation. © CIRAD

Regional cooperation

A multi-stakeholder platform for the Caribbean

dominique.martinez@cirad.fr
Regional director for Antilles-French Guiana

In the Caribbean, CIRAD's regional scientific cooperation strategy is based on a strong network of partners, which has been strengthened in the last few years around four key focal areas: agro-ecological cropping systems; genetic resource management, plant breeding and product quality; animal and plant health; and tropical forest dynamics. At the operational level, this strategy constitutes a major integrated project, structured into thematic sub-projects with cross-cutting lines on agro-ecology, agrobiodiversity, training and impacts, etc. It will be coordinated by a multi-stakeholder platform.

CIRAD's regional office presented the new platform to public and private stakeholders, both national and local, from the five French West Indies communities during the 11th conference on French West Indies-French Guiana regional cooperation. This conference is the main annual meeting for stakeholders in the five communities.

Samples from the banana collection Martinique © CIRAD

The Biological Resource Centre (BRC) for tropical plants in the French West Indies was certified according to the NF S96-900 standard. This French standard recognises the quality of activities conducted for sugarcane, banana, pineapple, mango and yam crops. Almost 2 500 varieties have been listed in the French West Indies, and are conserved by CIRAD and INRA, either in open fields or in vitro.

The final meeting of the **Banane durable Caraïbe (Caribbean sustainable banana) project** was held on 14 and 15 October. Over four years, this project coordinated by UGPBAN, the Institut Technique Tropical (IT2) and CIRAD, and financed by the European INTERREG IV Caribbean programme, has supported the development of innovative cropping systems throughout the region. These approaches could be continued within the framework of the INTERREG V programme.

jean-michel.risede@cirad.fr
Ecological Functioning and Sustainable Management of Banana and Pineapple Cropping Systems (GECO research unit)

The DEVAG project, focusing on horticulture, ended in March. Supported by the French embassies in Cuba and Haiti, and financed by the INTERREG IV Caribbean programme, this project is well ahead of all national agro-ecology directives, and is considered as a model. Its results are available online and on DVD.

paula.fernandes@cirad.fr,
Agroecological Functioning and Performances of Horticultural Systems (HORTSYS research unit)
http://devag.tropical-agroecology.org

CaribVET, the Caribbean animal health network, held its 9th Steering Committee Meeting on 5 and 6 May in Havana. The heads of Caribbean veterinary services were also able to attend the International Conference on Animal Health Surveillance (ICAHS), which took place in Cuba from 7 to 9 May, organised by the Centro Nacional de Sanidad Agropecuaria (CENSA) and an international committee made up of Cuban, Brazilian and European researchers (including those from CIRAD).

Launch of the agricultural research platform for the Indian Ocean (PReRAD)

The regional agricultural research for development platform for the Indian Ocean, PReRAD, has been launched. In June, Michel Eddi signed a framework agreement associating CIRAD, Réunion and the Indian Ocean Commission (IOC), for the creation of this platform. It will be coordinated by CIRAD from Réunion and Madagascar, and will involve 600 people, with half coming from CIRAD and the other half made up of partner teams from IOC countries.

L. Balberini © CIRAD

This platform responds to the need for the Indian Ocean countries to increase their food security by developing their complementarities in key agricultural sectors. Developing a regional partnership could attract additional international financing from European funds (FEDER). To this end, implementing a shared governance process with partner countries helps to structure cooperation around interests shared by ministries, universities and the private sector. These include animal and plant health, emerging diseases, agri-food systems and product quality, enhancing agrobiodiversity, and recycling organic waste.

PReRAD is the IOC's main scientific operator for food security. Its goal is to improve research excellence in order to support the development of agricultural sectors. The major thrust is loss reduction through the implementation of agroecological approaches. To achieve this, CIRAD will strengthen its hosting and research facilities, particularly in Réunion, in order to welcome teams, to assist them through assignments and to train them wherever needed. It will be supported by the Agreenium Consortium for academic and professional training, which will set up a regional mechanism for distance learning with universities.

gilles.mandret@cirad.fr
Regional director for Réunion-Indian Ocean

Renewing scientific cooperation with Côte d'Ivoire

CIRAD and the Centre National de Recherche Agronomique (CNRA) signed a framework cooperation agreement during the state visit by the French President to Côte d'Ivoire on 17 July. This agreement symbolises the renewal of CIRAD's scientific cooperation activities in Côte d'Ivoire, after a period of political unrest in the country. The agreement was signed in the presence of the Ivorian Minister for Research and Higher Education.

This cooperation particularly concerns the cacao sector: organising the sector and its producers; combating swollen shoot virus (CSSV); and recognising the quality of Ivorian production. Banana and plantain crops are also concerned, as are food crops. Cooperation will have three main strands – research, development and training –, with the support of Agreenium. **It could benefit from the Debt Reduction and Development Contract (C2D)** set up by France and signed by Côte d'Ivoire in December 2012 within the framework of debt reduction for developing countries. To this end, CNRA, CIRAD and the Fonds Interprofessionnel pour le Conseil et la Recherche Agricole (FIRCA) in Côte d'Ivoire will produce joint programming proposals.

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Yté Wongbé, Director of the Centre National de Recherche agronomique de Côte d'Ivoire and Michel Eddi.

patrice.grimaud@cirad.fr
Regional Director for Mainland West Africa

Cooperation with Senegal

CORAF STAKEHOLDERS ON THE AFD-CIRAD STAND AT THE 2014 PARIS INTERNATIONAL AGRICULTURAL SHOW. For the first time, the West and Central African Council for Agricultural Research and Development (CORAF/WECARD) and a large number of agricultural research partners from the southern countries, especially Senegal, were associated with the joint CIRAD-AFD stand at the Paris International Agricultural Show. The Minister Papa Abdoulaye Seck, Alioune Fall, Director-General for Senegalese agricultural research (ISRA), the Director of CORAF, Harold Roy-Macauley, his Programme Director, Aboubakar Njoya and Professor Sidi Seck of Gaston Berger University (UGB) in Saint Louis all provided important contributions to the many discussions and conferences, where they presented their activities.

denis.depommier@cirad.fr
Regional Director for Coastal West Africa

SINE SALOUM DE KAOLACK UNIVERSITY. Through Agreenium, CIRAD is accompanying the development of the agricultural education project for Sine Saloum de Kaolack University (USSK). A delegation of six members of Agreenium went to Senegal in October at the request of the rector of this new university in order to finalise a technical and financial tender. The agroecological approach advocated by France at the national and international levels was thus presented during a workshop chaired by the Senegalese Minister for Higher Education and Research. The project for the creation of this university, presented by its rector, is part of an ambitious national process as part of the Plan Sénégal Emergent (PSE). The University will open its doors in October 2016.

christian.hoste*@agreenium.org*

NEW AGREEMENTS. Michel Eddi went to Senegal in November, at the invitation of Papa Abdoulaye Seck, Minister for Agriculture and Rural Equipment. This visit was the opportunity to formalise relationships between CIRAD and its many Senegalese partners for research, agricultural development and higher education, as well as with the French Embassy, the Agence Française de Développement (AFD) and the Institut de Recherche pour le Développement (IRD).

CIRAD's President took part in the scientific and technical council of the Institut Sénégalais de Recherches Agricoles (ISRA), and met with the board of the West and Central African Council for Agricultural Research and Development (CORAF/WECARD), two long-standing active partner organisations. He also met with the teams from two platforms in partnership (PPZS and Divecosys) and from AfricaRice (CGIAR). He visited the IRD laboratories shared with ISRA and UCAD (LMI IE Sols and Biopass), which are currently hosting four CIRAD researchers.

A cooperation agreement was signed with Gaston Berger University (UGB), particularly geared towards sustainable agriculture and insect pest control, environmental risk management (GAED masters), and land and water management.

In the Senegal River region, an agreement was signed with the Office du Lac de Guiers (OLAG). It supplements the tripartite agreement already existing between CIRAD, IRD and the Société Nationale d'Aménagement et d'Exploitation des Terres du Delta du Fleuve (SAED) for the management of water resources, land and associated agricultural production (rice, horticulture).

denis.depommier@cirad.fr
Regional Director for Coastal West Africa

Ebola and food security in West Africa

Recommendations for FAO

"Maintaining supply chains and agricultural trade in the context of the Ebola virus disease in West Africa"

© P. Kone / FAO

From left to right: Patrick David ,Vincent Martin (FAO), Denis Depommier, Muriel Figuié and Arlène Alpha (CIRAD).

During the seminar organised by FAO on this subject in Dakar in December, CIRAD presented to an expert committee a report produced at the request of FAO for the worst hit countries (Guinea, Liberia and Sierra Leone). The participants refined this report and drafted recommendations with a view to restoring normal operations in agricultural supply chains and reducing the impact of the epidemic on food security for people in the region. FAO has delivered these recommendations to policy makers in the region.

arlene.alpha@cirad.fr
muriel.figuie@cirad.fr
Markets, Organisations, Institutions and Operators' Strategies (MOISA research unit)

An agreement between the government of Kenya and French research institutes

A framework cooperation agreement was signed between the three French research institutes present in Kenya (CIRAD, IFRA and IRD) and the Kenyan Ministry of Education, Science and Technology (MoEST) on 6 May in Nairobi, under the aegis of the French Embassy.

For CIRAD, this agreement legitimises a research and research training initiative which, in Kenya, translated chiefly into a partnership with the international research centres ICRAF (coffee and agroforestry), ICIPE (plant protection) and (ILRI) (livestock and markets). Based on the results of the previous period – more than 80 research programmes, 100 students supervised, almost 180 co-publications, and around 40 scientific events –, the new agreement recognises the importance of French contributions to the production of knowledge and scientific frameworks. Its goal is to consolidate institutional and scientific partnerships and to facilitate opening to the European Union.

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Patrick Caron, Director General in charge of Research and Strategy, and David Radcliffe, Senior Adviser, European Commission.

Celebrating FARA

A meeting in Johannesburg

A large delegation from CIRAD attended the event organised by the Forum for Agricultural Research in Africa (FARA) in Johannesburg from 26 to 29 November. "Celebrating FARA" brought together more than 600 participants, including representatives from most of the national and regional agricultural research organisations in Africa, the African Union, NEPAD and the European Union. Patrick Caron met with partners from the ProIntensafrica project, which has just been awarded European funding for two years in order to develop a joint Europe-Africa programme. CIRAD also took part in several special sessions: "Climate smart agriculture" and "Innovation platforms", improving agricultural training and skills, and the PAEPARD platform (Platform for African-European Partnership on Agricultural Research for Development).

Within the framework of the Centre for the Study of Governance Innovation (GovInn), CIRAD, a partner of the University of Pretoria, contributed to the organisation of the week on governance innovation from 2 to 7 June. Vandana Shiva, an Indian environmental activist and feminist, recipient of the Right Livelihood Award, gave a conference on this occasion entitled "Rethinking Development in the 21st Century".

jacques.lancon@cirad.fr, Regional Director for Southern and East Africa

An agreement protocol between CIRAD and the Madagascan Ministry of Higher Education and Scientific Research (MESUPRES) was signed by Michel Eddi and the Minister Marie Monique Rasoazananera in June. It sets out the terms for CIRAD's support for Madagascan research policy within the framework of joint programmes led by mixed research teams.

pascal.danthu@cirad.fr, Regional Director for Madagascar

France-North Africa conference on agricultural and veterinary research

This conference took place on 31 October in Tunis, and brought together the directors of agricultural research institutes and professional agricultural representatives from Algeria, France, Morocco and Tunisia. This annual meeting was launched in 2013 in Meknès. Its goal is to define priorities for research and partnerships between Mediterranean countries on the adaptation of Mediterranean agriculture to global changes. CIRAD's presence in North Africa is largely based on the SIRMA network (irrigated systems in North Africa) and projects financed by the European Union, the Agence Française de Développement, the Agence Nationale de la Recherche and Agropolis Fondation.

Results and outlook for action conducted since the Meknes seminar

A number of research in partnership activities are underway in the region, especially in the context of projects with European funding (FP7, "Neighbourhood" or ARIMNet1), but also ANR and AFD funding. The SIRMA partnership network, led by CIRAD, is central to these projects. Launched in January, the ARIMNet2 programme (Coordination of Agricultural Research in the Mediterranean Area) involves 16 partner countries and is coordinated by INRA. IAV Hassan II and ANR-France provide the secretariat for calls for proposals. French-North African collectives have already been set up to draft proposals. Other France-North Africa initiatives will be developed, especially in the context of H2020 and ERANETMED European calls for proposals.

Finally, with the aim of increasing the impact of research, professionals have been more closely associated with projects. Training initiatives will be conducted at all levels.

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Opening of the conference by Messrs Stéphane le Foll and Lassaad Lachaal, Tunisian Minister of Agriculture

Three priority research topics

Partnerships prioritise three topics:

> Animal health and vector-borne diseases. The goal of the REMESA network (Mediterranean Animal Health Network, FAO-OIE), which includes 10 Mediterranean countries, is to coordinate the development and implementation of regional projects and programmes. The CMAEE research unit (CIRAD-INRA) and the IRESA and IAV-H2 institutes are setting up joint projects in this context.

> Water and land management. The numerous initiatives led by the SIRMA partnership network and the SICMED project (INRA, IRD) demonstrate the existence of a collective capacity to develop and successfully implement research projects.

> Improving plants and cropping systems. A number of projects are underway (the Arcade-Agropolis Fondation project, theses under joint supervision, AgreenSkills mobility). These concern, among others, durum wheat, Mediterranean fruit trees, water shortages, tolerance to saline stress (citrus fruits, rice) and conservation agriculture. These partnerships are often bilateral and could be extended within a multilateral framework.

The next annual conference will be held in Algeria in 2015.

jean-luc.battini@cirad.fr
Mediterranean Project Manager

Strengthening France-Brazil partnerships for sustainable development in the Amazon

Five years after the France-Brazil agreement on sustainable development in the Amazon biome and its first seminar in 2009, the seminar on "Research and public policy for sustainable development in the Amazon" was organised on 11 and 12 December in Brasilia. Almost 100 participants, policy makers, donors and research partners of CIRAD (platform in partnership on "Forests, agriculture and territorial development in the Amazon") and IRD (regional multidisciplinary programme on "Environmental dynamics, resources and societies in the Amazon") were thus able to share their visions and their methods of intervention and to discuss the future.

The seminar was also the opportunity to present the France-Brazil GUYAMAZON programme, whose goal is to support joint research, training and innovation projects and to help to consolidate partnerships between French Guiana and the Brazilian Amazon states. The programme launched in 2012 brings together 132 researchers from 32 institutions, and could be extended to other partners. It includes the French Embassy, the French Guiana region, IRD, CIRAD and research support foundations in the states of Amazonas, Amapá and Maranhão.

bernard.mallet@cirad.fr
Regional Director Brazil

Find out more about the Amazon biome
http://www.accord-biome-amazonien.org

Find out more about GUYAMAZON
http://www.ird.fr/les-partenariats/programmes-multilateraux/guyamazon

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Frédéric Huynih (IRD), Doris Sayago (CDS/UNB) and Bernard Mallet, CIRAD Regional Director for Brazil, opening the seminar in Brasilia. © CIRAD


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Participants in the «One health in action» workshop

Animal health in Asia

THE REGIONAL RESEARCH PLATFORM IN ASIA (PRR-ASIE), built on the site of the Institut Pasteur du Cambodge, was officially inaugurated in March by the Cambodian Minister for Health, Mam Bun Heng, in the presence of ambassadors from France and from Asian countries as well as high-level national and international health officials. This platform was developed by the Alliance Nationale Française pour les Sciences de la Vie et de la Santé (Aviesan Sud), of which CIRAD is an associate member. The inauguration was followed by an international symposium on emerging infectious diseases in Southeast Asia

THE COMACROSS PROJECT, Companion approach for cross-sectoral collaboration in health risks management in SEA, financed by the European Union and coordinated by CIRAD, has been launched. Its aim is to develop capacities, in particular in the most vulnerable Southeast Asian countries, and to prevent and manage risks associated with emerging infectious diseases. The project associates Kasetsart University (KU), the Institut Pasteur du Cambodge (IPC), the University of Oxford, the Lao-Oxford-Mahosot Hospital Wellcome Trust Research Unit (LOMWRU) and the National University of Laos (NUoL).

philippe.girard@cirad.fr
Regional Director for Mainland Southeast Asia

A NEW INTERNATIONAL MASTER'S PROGRAMME, INTERRISK, on the assessment and management of health risks at the human-animal-ecosystems interface (InterRisk) is being set up in Thailand. It is the result of collaboration between the Faculty of Veterinary Medicine at Kasetsart University, the Ecole Vétérinaire de Toulouse (ENVT) and CIRAD. The course will be taught in Bangkok, Thailand, at Kasetsart University, one of CIRAD's partners. This Master's degree could lead to a PhD in veterinary science at Kasetsart University. It will be conducted in association with Agreenium within the framework of the Grease network.

THE SEA-EU-NET NETWORK aims to strengthen scientific cooperation between Europe and Asia. The expert workshop entitled "One Health in Action", which brought together numerous partners in Hanoi in October, helped to identify research requirements in Southeast Asia in the field of health surveillance. The network has also set up a One Health master class: 10 days in France at CIRAD in October, followed by a 10-day trip to Thailand in 2015. This master class will enable 12 young scientists from a broad range of backgrounds to develop joint research projects, with the goal of fostering multidisciplinary approaches.

flavie.goutard@cirad.fr
Animal and Integrated Risk Management (AGIRs research unit)
http://sea-eu.net

Oil palm and the environment
The challenge of sustainability

alain.rival@cirad.fr
Regional Director for Southeast Asian Island countries

The International Conference on Oil Palm and the Environment (ICOPE) was held in Bali in February under the heading "Oil Palm Cultivation: Becoming a Model for Tomorrow's Sustainable Agriculture". For the fourth time since 2007, CIRAD organised this conference along with the Indonesian company PT Smart and the NGO WWF Indonesia.

For several decades, under pressure from civil society and NGOs, stakeholders in this sector have been radically transforming operating systems, generating standards for sustainability and investing in major international research projects. The aim of these efforts is to gain a better understanding of the determinants of sustainability and the interactions between natural areas and plantations. Thanks to its expertise and knowledge in the field, CIRAD has been closely involved in these discussions. The projects in partnership SPOP (Sustainable Palm Oil Production) and PRIGOUE (the role of private multi-stakeholder standards in global environmental governance), supported by the Agence Nationale de la Recherche, contribute to this process.


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Measuring soil quality in an oil palm planting, Indonesia

FOCUS

on the year of FAMILY FARMING

In Madagascar, clove harvesting is a family activity. This small girl has come to the orchard with her parents for the harvest
E. Malézieux © CIRAD

See our full report on family farming:

www.cirad.fr

tab > **Research operations**
heading > **Research Topics**

FOCUS

2014 was declared International Year of Family Farming (IYFF) by the United Nations.

Improving production and living conditions for family farmers is a major priority for CIRAD. Through a range of scientific and communication operations, in France and worldwide, it both developed and promoted its expertise in this topic, to which it is deeply committed, throughout 2014.

Since 2012, Jean-Michel Sourisseau, a socio-economist, has been coordinating CIRAD's work on family farming to prepare for the international year.

He takes stock of the past year below.

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2014 was declared INTERNATIONAL YEAR OF FAMILY FARMING by the United Nations. By virtue of its mandate, CIRAD played a major role in publicizing France's commitment to this topic. What conclusions can the establishment draw from this year?

This was an extraordinary opportunity to promote our know-how in terms of both scientific output and global communication. As regards publications, the inventory for 2014 was 26 articles, six books, 17 book chapters and no fewer than 18 papers. One of the highlights was the organization of the International Encounters on "Family Farming and Research" with Agropolis, the GFAR[1], the CGIAR[2] and the WRF[3], the only research-based event on the agenda for the International Year. We were also able to work extensively with members of the public, who were particularly interested in this topic. At the Paris International Agricultural Show, we organized debates and conferences on a 200-m² stand created in partnership with the AFD[4] and France Médias Monde. The travelling exhibition we produced with the AFD, the Institut français and the IRD[5] travelled the world in its different language versions and was widely used in France by regional and town councils and agricultural colleges.

How can you explain the significant interest in a topic that would seem to be of more concern to southern countries?

It is far from being a "southern" topic, and we are wrong to think it is. In France, 80% of farms are family-run, and the young French farmers' union (JA) is questioning the limitations of the current model of modernization in relation to the concept of family farming. On a global scale, people and civil society are increasingly concerned about the origin of the products they consume, the risks of industrialized farming, and its economic, social and environmental consequences. The growing media coverage of these concerns clearly started with the food riots of 2008. They revealed the extent of the "financialization" of agriculture. This contributed substantially to the opening of discussions about production models and the role of public opinion in many countries.

What do you think of the report on IYFF 2014 submitted to French ministers Stéphane Le Foll and Annick Girardin by Henri Rouillé d'Orfeuil[6]?

We are obviously delighted by the coverage it gives to CIRAD! It mentions the quality of our publications and activities and stresses our role as a link with international agricultural research organizations such as the CGIAR or the GFAR. This is proof of the quality of our operations in this field.

And what now, after 2014?

There are many issues on which we will be working with our French partners (the IRD, INRA, Agreenium, research institutes in developing countries, etc), going beyond national and international recommendations. It has been suggested that we might set up and run a scientific and academic network centring on family farming. We feel that changing agricultural policy and taking account of this type of production are major issues for both Europe and the countries hosting our research. We are therefore continuing to focus on family farming and support the FAO platform of knowledge on family farming (http://www.fao.org/family-farming/en/) and the World Rural Forum's idea of prolonging the efforts made in 2014 in the form of a decade of family farming.

1. GFAR: Global Forum on Agricultural Research
2. CGIAR: Consultative Group for International Agricultural Research
3. WRF: World Rural Forum
4. AFD: Agence française de développement
5. IRD: Institut de recherche pour le développement
6. IYFF Coordinator for France

Major progress for research

By 2050, agriculture will have to feed nine billion people. What role will family farming play?

In terms of research, there are four key aspects.

> Family farmers are becoming a sociopolitical category in their own right

A definition is emerging: "family" farming is practised on farms that make use of family labour, without any full-time staff. The many discussions about the chosen criterion (no full-time staff), which reflects the interlinking between the family and their farm, revealed the existence of a continuum, right through from small-scale family farms to capitalist agricultural firms.

> Family farming is a key factor in contesting the "conventional" agricultural model

Introducing the notion of the family into the debate on agricultural models sheds a different light on the many challenges facing agriculture:

- Creating jobs and alleviating poverty.
- Ensuring food security.
- Reconciling production and the natural environment.
- Promoting rural regions.
- Addressing health risks.
- Mitigating climate change.
- Fostering the energy transition.
- Building solidarity.

> Family farming, a research topic

Major steps have been made:

- Family farms can feed the world and supply markets; they are now producing much more, in terms of both volumes and value, than firms.
- The practices and performance of most farms worldwide depend on the links between domestic life and productive activities.
- Agricultural production can be seen within a broader development perspective.

The FAO estimates that 2.6 billion people and more than 500 million farms account for almost 80% of global food production.

> But family farming still raises questions

- How can we measure agricultural performance? What new practices, alternative models and support systems should be adapted to family rationales?
- What data do we need to gather and analyse to really pinpoint the weight and importance of the different types of agriculture?
- What public policies are required: less sector-based, more diverse and more coordinated?

jean-michel.sourisseau@cirad.fr
Actors, Resources and Territories in Development (UMR Art-Dev)

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PARTNERS

France > Institut de recherche pour le développement (IRD); University of Aix-Marseille. **Kenya >** National Genebank of Kenya (KARI)

CROP DIVERSITY

Social structure is a determining factor

How do human societies influence crop evolution processes? Researchers from CIRAD and their partners recently demonstrated that sorghum genetic diversity distribution in eastern Kenya was linked to the ethnic origin of farmers. The results showed that as regards the varieties identified by farmers and from a genetic point of view, spatial distribution of sorghum diversity was associated with ethnic structure. While introduced varieties, obtained through the formal varietal improvement system, were uniformly distributed within the three ethnic groups, several local varieties identified by the farmers were unequally distributed between the groups. Taking this social dimension into account would make genetic resource collection and characterization programmes more efficient. This is a major issue for resource conservation.

vanesse.labeyrie@cirad.fr, Genetic Improvement and Adaptation of Mediterranean and Tropical Plants (UMR AGAP)

PLoS One, 9: e92178. Doi: 10.1371/journal.pone.0092178

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PARTNER

France > Centre d'études et de recherches sur le développement international (CERDI)

RESILIENCE, VULNERABILITY AND SUSTAINABILITY

How to assess farming systems

In the Lake Alaotra region of Madagascar, farms face a number of risks. What is their capacity to innovate and adapt? On what criteria can we base analyses of their vulnerability, resilience and sustainability? Researchers from CIRAD have chosen a number of appropriate indicators on the scale of the activity system comprised of a household and its farm. Using those indicators, they revealed that on the whole, farms were highly resilient with respect to climatic and socioeconomic hazards. That resilience can be put down to the range of activities practised, including non-agricultural activities. It is also due to the relatively high technical innovation capacity of the crop and livestock production systems, which is itself the fruit of the many development projects in the region in the past. This study is a step along the way to building a World Agriculture Watch.

eric.penot@cirad.fr, Innovation and Development in Agriculture and the Food Sector (UMR Innovation)

helene.david-benz@cirad.fr, Markets, Organizations, Institutions and Stakeholders Strategies (UMR MOISA)

Ethique et économique, 11: 44-61.
papyrus.bib.umontreal.ca/xmlui/bitstream/handle/1866/10261/Penot%20et%20al.-11%281%29.pdf

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PARTNERS

Egypt > Animal Production Research Institute (APRI); Desert Research Center (DRC); Matrouh Governorate; International Center for Agricultural Research in the Dry Areas (ICARDA). **France >** Institut national de la recherche agronomique (INRA)

LIVESTOCK PRODUCTION IN EGYPT

A factor in adapting to global change

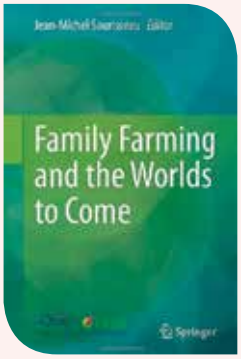
The Mediterranean is facing unprecedented social and environmental changes that are increasing its fragility. Could livestock production, which has always played a fundamental role in shaping landscapes and in household finances, also have a role to play in the resilience of such regions? How able is it to adapt to global change? A research project coordinated by CIRAD provided answers to these questions for the coastal parts of Egypt, which have suffered fifteen years or so of exceptional drought. The results revealed the central role of tribal social structure in access to and use of resources, particularly land, and also in families' ability to adapt. They also highlighted the Bedouins' ability to adopt new activities, among other things by migrating, and the role of that diversification in the impact of drought on their living conditions. However, despite the many different types of diversification, livestock production is still a vital component of Bedouin society: livestock still provides social insurance for Bedouins who have moved to towns or abroad, and economic insurance for those who have remained in rural areas.

veronique.alary@cirad.fr, Mediterranean and Tropical Livestock Systems (UMR SELMET)

jean-francois.tourrand@cirad.fr, Management of Renewable Resources and Environment (UPR GREEN)

Agricultural Systems, 128: 44-54. Doi: 10.1016/j.agsy.2014.03.008

PUBLICATIONS



Family Farming and the Worlds to Come

This book, the fruit of collaborative work by CIRAD, recognizes three decades of research on the topic. It reviews the most used approaches to analyse and understand family farming, which is at the heart of the world's farming systems. It is crucial to define family farming clearly so as to pinpoint the challenges better and place it in a more global context, in order to judge its contribution to sustainable, fairer development. This type of production is thus at the heart of debates on agricultural development.

J-M. Sourisseau (ed.), 2014. *Family Farming and the Worlds to Come*. CIRAD-AFD. Springer

The book ***Políticas públicas y agriculturas familiares en América Latina y el Caribe: balance, desafíos y perspectivas*** presents the diversity of family farms in Latin America and of public policies relating to the sector. It is a compilation of the results of a study by CIRAD and twenty Latin American partners, and is one of the bases for the debates being organized as part of an international seminar, Politicas publicas y agricultura familiar en América Latine y el Caribe, held from 2 to 5 November 2014 in Santiago, Chile.

* Within the Public Policy and Rural Development in Latin America network (DP PP-AL).

Políticas públicas y agriculturas familiares en América Latina y el Caribe: balance, desafíos y perspectivas. Coord. E. Sabourin, M. Samper, O. Sotomayor. CEPAL, CIRAD, IICA, Red PP-AL co-publication. 2014

In Latin America, 14 million farms are family farms

And for more information...

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***Bois et forêts des tropiques* no. 319. Special issue on family farming.**
All articles accessible free of charge on the journal's website: http://bft.cirad.fr/

Perspective no. 27. Sustainable cocoa production – Learning from agroforestry

Perspective no. 29. Public policy for family farming – Definition for better support
To download issues of *Perspective*:
http://www.cirad.fr/en/publications-resources/publishing/perspective-policy-brief

Promoting family farming in Latin America

From 2 to 5 November 2014 in Santiago, Chile, family farming in Latin America was the focus for decision-makers and public policy specialists. CIRAD, CEPAL, the FAO, IFAD, the Ministry of Agriculture in Chile and the IICA organized an international seminar, "Políticas públicas y agricultura familiar en América Latina y el Caribe". The aim was to take stock of public policy as regards family farming in this world region and define the challenges and prospects for the coming fifteen years.

eric.sabourin@cirad.fr
Actors, Resources and Territories in Development (UMR ART-Dev),
Leader, Public Policy and Rural Development in Latin America network

www.pp-al.org

The participants in the plenary session of the seminar at CEPAL © CIRAD

MEETINGS/EVENTS

1st International Meeting
MILK, VECTOR OF DEVELOPMENT

In addition to their major role in nutrition, milk and dairy products have a significant heritage and cultural aspect to them. In developing countries, they play a key role in the local economy and often involve women. Agreenium, of which CIRAD is a founding member, and the *Consorzio Ricerca Filiera Lattiero Cascaria* (CoRFiLaC), organized the 1st International Meeting on "Milk, Vector of development" in Rennes, from 21 to 23 May. The meeting focused on sharing experiences of the technical and health challenges surrounding milk and milk processing, and demonstrating the diversity of dairy models worldwide

bernard.faye@cirad.fr
Mediterranean and Tropical Livestock Systems (UMR SELMET)

International Meeting in Montpellier

"Family Farming and Research"

From 1 to 3 June, Montpellier hosted more than 250 farmers, leaders of smallholder organizations, NGO managers, policy-makers, development staff, researchers and activists from every continent who had come to discuss the issues for research on, for and with family farms. Many leading scientific experts contributed to the debate, including Hans Herren, President of the Millennium Institute and holder of the 2013 Alternative Nobel Prize (Right Livelihood Award), who gave talk in from of a large audience on whether family farming was a credible option in view of the challenges facing the planet. CIRAD played an active role in preparing for and overseeing the conference, which was organized by Agropolis International in partnership with several national and international organizations.

http://www.agropolis.fr/actualites/2014-retour-rencontres-internationales-agricultures-familiales-recherche.php

Family farming in Madagascar
AN ASSET FOR SUSTAINABLE DEVELOPMENT

This was the topic for a week of meetings organized by CIRAD and FOFIFA, with the support of the European Union, at the University of Antananarivo, from 13 to 17 October. Specific seminars were run for scientists, producers' organizations and politicians. The CIRAD exhibition on family farming was on show to the public for ten days, and World Food Day was celebrated during the event. A document summarizing and promoting the contributions and discussions is available.

pascal.danthu@cirad.fr, Regional Director for Madagascar

www.cirad.mg/aiafmada

Women farmers taking their products to market in the Lake Alaotra region, Madagascar P.-Y. Le Gal © CIRAD

2014 AFTER International Congress
PROMOTING TRADITIONAL AFRICAN PRODUCTS

An EU project, AFTER *(African Food Tradition rEvisited by Research)* is working to associate Africa and Europe to work towards a joint objective: to improve traditional African products by sharing and building knowledge of agrifood technologies. Il The aim is to develop or create products or technologies of interest to European or African agrifood firms. The first internationl congress of the AFTER project, co-organized by CIRAD, the Ecole supérieure polytechnique (ESP-UCAD, Senegal) and the Afrique Agro Export Association (AAFEX), was held in Dakar on 11 and 12 November on the topic "Promoting traditional African foods: innovations, quality and market access". It was attended by the whole range of stakeholders from the agrifood sector. The results of research on some twenty traditional products were presented.

dominique.pallet@cirad.fr, Integrated Approach to Food Quality (UMR QUALISUD)

www.after-fp7.eu/

RESEARCH RESULTS

Village market
in northern Vietnam
B. Locatelli © CIRAD

www.cirad.fr/en/
tab > Research operations
> Research results

ECOLOGICALLY INTENSIVE AGRICULTURE

The transition to ecological intensification
THE ROLE OF SCIENTIFIC RESEARCH

The point of view of François-Xavier Côte, Director, Tropical Production and Processing Systems Department (PERSYST)

WHAT DO AGRO-ECOLOGY AND ECOLOGICAL INTENSIFICATION MEAN TO CIRAD?

A very wide range of agricultural production models claim to be agro-ecological (conservation agriculture, organic farming, agroforestry, etc). To develop and support the switch to agro-ecology as effectively as possible in various contexts in the South, CIRAD has chosen to focus its research on ecological intensification. This approach aims to satisfy production requirements while providing a range of ecosystem services, including reducing the use of synthetic inputs. Ecological intensification is made possible by boosting the biodiversity that exists within farming systems and fostering natural pest and disease regulation and the efficiency of bio-geochemical cycles.

HOW IS THIS REFLECTED IN CIRAD'S RESEARCH TOPICS?

CIRAD's research aims to understand better the biophysical, ecological, economic, social and institutional mechanisms that govern farming systems based on the principles of agro-ecology. CIRAD conducts research not only on ecological processes, but also on the design and participatory assessment of cropping systems with farmers, and the analysis and support of innovation systems to back up the ecological transition on various scales, particularly territories. This is a novel scientific standpoint that enables us to make our research more relevant by pooling the knowledge generated by our three departments and being directly involved in innovation processes in the field.

ARE THE RESULTS VISIBLE IN THE FIELD?

Yes, and I hope they will be even more so in future, given CIRAD's investment in research on agro-ecology and ecological intensification. There have already been very concrete results within our research and training platforms in partnership (PPs). For instance, we could mention what is being done in Madagascar on upland rice growing, in Southeast Asia and West and Central Africa on food crops, in Africa and Central America on agroforestry and in the French overseas regions on fruit and market garden crops, among others.

AND WHAT NEXT?

Research has a vital role to play, and we need to carry on working to combine the generation of knowledge with practical applications in the field, along with producers and development players. We must continue to boost our knowledge of the ecological and biophysical processes at play in the various production contexts in the South, pursue our studies of the range of technical options, and test and assess those options. Research has to carry on helping players complete the energy transition on a farm scale and also, vitally, on a regional scale. This should enable us to develop collective action, support structures and information operations and influence public policy, and in short give us every chance of success and of having a real impact in the field.

Organic waste

A treasure trove for agriculture?

On Réunion island, sugarcane crop fertilization currently largely relies on imported mineral and synthetic fertilizers. Farmers are therefore subject to fertilizer availability and price volatility. In the light of the global exhaustion of phosphorus resources, organic waste of animal, urban or agro-industrial origin is a real treasure trove for future crop fertilization. CIRAD recently launched an in-depth study of the phosphorus fertility of soils in Réunion and maintenance of that fertility using various types of organic waste. The first results are expected in 2015.

cecile.nobile@cirad.fr
matthieu.bravin@cirad.fr
(Recycling and Risk)

http://sps2014.cirad.fr/

Sugarcane accounts for 60% of the cultivated land in Réunion

The *Coffea canephora* collection held in French Guiana © T. Leroy/CIRAD

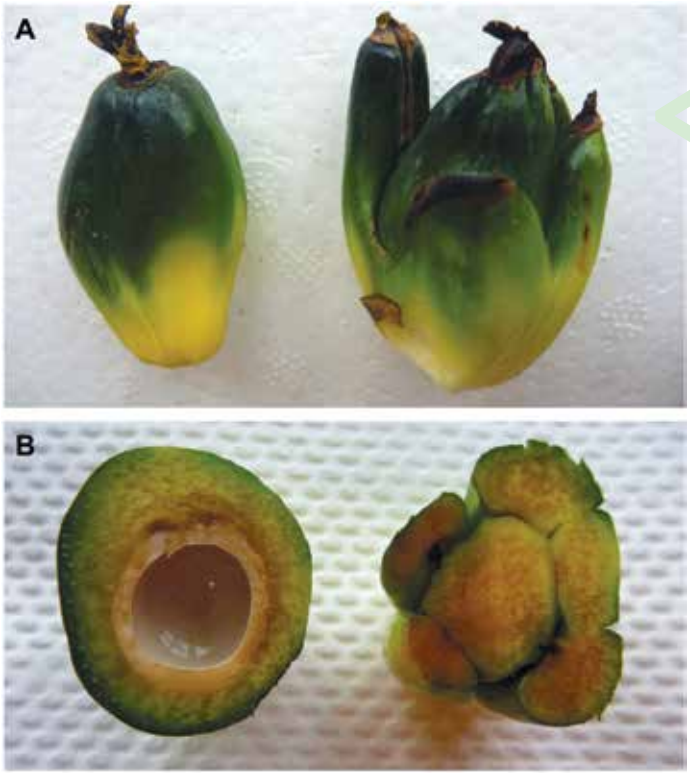
PARTNERS
Democratic Republic of Congo > University of Kinshasa.
Ecuador > Instituto Nacional de Investigaciones Agropecuarias (INIAP).
France > Institut national de la recherche agronomique (INRA).
Ivory Coast > Centre national de recherche agronomique (CNRA).
Uganda > National Agricultural Research Organisation - Coffee Research Centre (NARO-COREC).

COFFEE
CORE COLLECTIONS FOR BETTER EXPLOITATION OF DIVERSITY

thierry.leroy@cirad.fr (Genetic Improvement and Adaptation of Mediterranean and Tropical Plants - UMR AGAP)

Researchers from CIRAD and their partners recently built several core collections of Coffea canephora coffee trees, based on an analysis of the genetic diversity of the species. These small-scale collections, which are easier to manage and maintain than the vast collections currently held by research centres, will be valuable tools for breeders, and should enable them to address the new issues now facing coffee producers, be they related to pests and diseases or to climate change. On a global scale, they should facilitate the construction of a coffee genetic resource conservation network, within which planting material and information can be exchanged. These collections will also serve to make better use of these resources within breeding programmes the world over, and open the way for studies of association and for global management of coffee genetic diversity.

Coffea canephora. Genetica, 142: 185-199.
Doi: 10.1007/s10709-014-9766-5



A. Whole oil palm fruits: normal, on the left, and mantled, on the right. In this case the virescens variety, whose fruits are bright green until fully ripe **B.** Cross-section of oil palm fruits: normal, on the left, mantled, on the right. In this case the virescens variety, whose fruits are bright green until fully ripe

OIL PALM
A STEP TOWARDS UNDERSTANDING THE MANTLED FLORAL ABNORMALITY

estelle.jaligot@cirad.fr
(Crop Diversity, Adaptation and Development – UMR DIADE)

The mantled floral abnormality, which affects oil palms produced by in vitro cloning, is of epigenetic origin and causes a malformation of the stamens. Researchers from CIRAD, the IRD and FELDA set out to understand how the epigenetic regulation defect in abnormal palms affects one of the main genes that control stamen development. The researchers detected an alternative transcript produced by the EgDEF1 gene, which was shorter than the complete transcript previously known for the gene and potentially coded for a partially non-functional protein. By quantifying the number of copies of each of the two transcripts in normal and mantled flowers, the researchers demonstrated that in the latter, the short molecule was produced at sufficiently high levels to compete with the long form. Although the reasons behind the accumulation of the short transcript remain to be determined, this discovery provides a new possibility for explaining, on a molecular level, the formation of mantled flowers and, in the longer term, developing an early detection test for the abnormality in oil palm.

PLoS One, 9: e91896. Doi: 10.1371/journal.pone.0091896

PARTNERS
France > Institut de recherche pour le développement (IRD).
Malaysia > FELDA Biotechnology Centre.

Photo-ethnographic approach: a farmer taking a picture of what he sees as a relevant indicator for characterizing a soil type © B. Defives/Transit

PARTNERS

France > Centre de recherche et d'enseignement de géosciences de l'environnement (CEREGE); Ecole centrale de Lyon; École normale supérieure de Lyon; Institut de recherche pour le développement (IRD); University of Paris 7.
Senegal > Laboratoire commun de microbiologie

PARTICIPATORY RESEARCH
BETWEEN FARMER KNOW-HOW AND SCIENTIFIC EXPERTISE

frederique.jankowski@cirad.fr
(Management of Renewable Resources and Environment)

Researchers chose to look at how local and scientific knowledge is legitimized in the course of participatory research. They studied how knowledge and its legitimacy are defined, and also the link between legitimization and reappropriation of know-how resulting from collective action. Knowledge legitimization processes may either strengthen or weaken the position or affiliations of individuals and groups within the multiple communities to which they belong. Above and beyond the processes described, the approach served to identify what constitutes the knowledge area built up through participatory research, a fragmented space whose edges do not correspond to those of «laboratories» in the conventional sense. This participatory knowledge production area highlights a paradox: working in partnership gave the project's researchers social legitimacy, but did not necessarily boost their legitimacy within the scientific community.

Natures, sciences, sociétés, 22: 15-22. Doi: 10.1051/nss/2014015

Panicle of a sterile male rice plant at the flowering stage: the whitish anthers are empty © N. Ahmadi/CIRAD

RICE BREEDING
IDENTIFICATION OF THE MALE STERILITY GENE MS-IR36

nourollah.ahmadi@cirad.fr (Genetic Improvement and Adaptation of Mediterranean and Tropical Plants - UMR AGAP)

Rice breeders at CIRAD use a male sterility gene to facilitate crossing within their improvement programmes. They recently identified its position in the genome and its function, using the crop's genome resources, which are now well developed. They adopted a «conventional» positional cloning approach, consisting in isolating the gene using the markers associated with it. They pinpointed the polymorphism concerned very precisely: SNP (single-nucleotide polymorphism) associated with ms-IR36 male sterility. The researchers did not need to bother with functional validation of the gene, since once identified, they discovered that it had already been described from another mutant obtained for a japonica variety, although the SNP relating to that mutant was different from the one linked to ms-IR36 male sterility.

Molecular Breeding, 33: 555-567. Doi: 10.1007/s11032-013-9972-3

PARTNER

France > Institut national de la recherche agronomique (INRA).

Research and training platform in partnership (PP)

DEVELOPING SUSTAINABLE AGRICULTURE AND PRESERVING WILDLIFEE

The "Production and Conservation in Partnership" research platform (RP-PCP) provides a framework and support for applied research and higher education aimed at promoting the co-existence of agricultural activities and wildlife preservation in the grasslands of southern Africa. Using interdisciplinary and intersectoral approaches, it attempts to reconcile agriculture and biodiversity conservation on the fringes of protected areas.

Professor Eddie Mwenje is Chair of the RP-PCP Steering Committee. Along with the platform's leaders, he coordinates the activities of the four scientific organizations that are partners in the platform, and the French Embassy.

edmwenje@gmail.com

www.rp-pcp.org

CAN YOU TELL US ABOUT THE RP-PCP?

Eddie Mwenje: RP-PCP has been in official existence since 2007. It was set up to build research capacity and institutional partnerships in Zimbabwe and more broadly in southern Africa, by developing collaboration and information sharing and dissemination with French and European research organizations. The aim of this platform, which is at the interface between man and nature, is to contribute to sustainable development, conservation, and improving living standards for people living in rural areas in Zimbabwe, a country that has been through several serious crises, and in neighbouring countries. We are now facing a range of challenges resulting from global and local change that are threatening both rural populations and biodiversity conservation.

WHAT ARE YOUR FIELDS OF ACTIVITY?

E.M.: RP-PCP is working on four main topics: animal health and the environment, notably including management of infectious diseases at the interface between man, livestock and wildlife; functional ecology in interface areas; agriculture and conservation; and natural resource governance and sustainable management. More than 70 researchers from Universities in Zimbabwe, South Africa, Zambia and Botswana, and French and international organizations, including fourteen regularly involved in coordinating the platform, have worked with us since 2007. A major part of our work also consists in training and supervising postgraduate students, most of them from Zimbabwe and the SADC.

WHAT ADDED VALUE DOES CIRAD PROVIDE?

E.M.: CIRAD has been in Zimbabwe since the start of the 1990s, and its researchers know the region well. We are benefiting from that experience. This is an exchange that goes well beyond scientific aspects alone, since it also involves policy-makers, NGOs and rural communities. CIRAD's researchers also play a fundamental role in supervising students. They are thus building skills in terms of research activities, and also of student supervision. Over seven years, more than 70 students have been or are still being trained within the platform. An international network of scientists has been built. We have gained greater visibility and are opening up to other countries, as shown by the RP-PCP AHEAD conference organized in Hwange in May 2014, which was attended by 140 people from various horizons. Our scientific output is also abundant, since we have published more than 80 articles and book chapters since 2007.

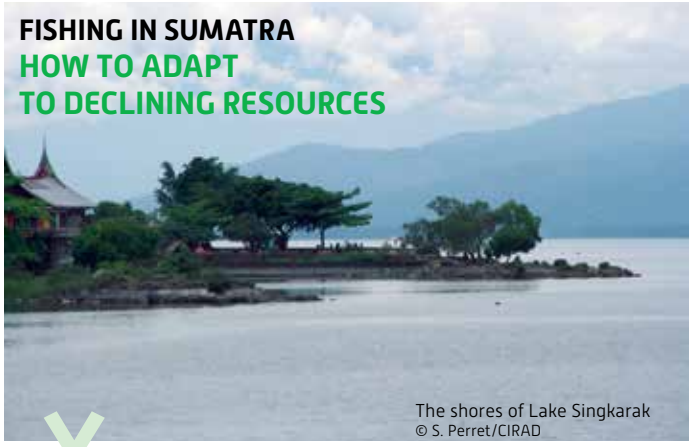
Picture painted to order for the RP-PCP © Irène

PARTNERS

France > CNRS: Institut de l'écologie et de l'environnement; UMR Lyon1-LBBE; UMR CEFE; CIRAD (Internal Research Units: AGIRS; AIDA; BSEF; GREEN; Joint Research Units: INNOVATION, MOISA, INTERTRYP; INNOVATION; G-EAU).

Zimbabwe > University of Zimbabwe: Departments of Geography and Environmental Science; Animal Sciences, Biological Sciences; Centre for Applied Social Science; Faculty of Veterinary Science; Soil Science and Agricultural Engineering; Agricultural Economics; National University of Science and Technology: Faculty of Forest Resources and Wildlife Management, Institute of Development Studies.

FISHING IN SUMATRA
HOW TO ADAPT TO DECLINING RESOURCES



The shores of Lake Singkarak
© S. Perret/CIRAD

sylvain.perret@cirad.fr
(Water Management, Stakeholders and Uses - UMR G-EAU)

In the waters of Lake Singkarak, in Sumatra, fish are becoming increasingly scarce and fishing, an essential activity and livelihood for local people, has seen catches shrink. What are the reasons for this decline, and how can it be remedied? A multi-disciplinary team investigated the fishing practices, livelihood systems and processes at play in order to find solutions acceptable to all the stakeholders concerned. Its results have been presented to the provincial authorities, village communities and fishermen's representatives. They have served to change the viewpoints held by the various groups. The fishermen have recognized that some of them are over-fishing, disobey regulations and use illegal methods. The traditional communities agree that the existing institutions need to be revised so as to make better use of the lake's resources. The provincial authorities, for their part, have committed to negotiating with fishermen's representatives with a view to drafting new fishing regulations and fighting extreme illegal practices.

Regional Environmental Change, 14: 1203-1214.
Doi: 10.1007/s10113-013-0554-z

PARTNERS
Indonesia > Andalas University. **Thailand >** Asian Institute of Technology (AIT).

PTEROCARPUS OFFICINALIS/TARO FARMING SYSTEM
SYMBIONTS AND NITROGEN TRANSFER

antoine.galiana@cirad.fr
(Laboratory of Tropical and Mediterranean Symbioses – UMR LSTM)

Pterocarpus officinalis Jacq. is a legume tree native to the Caribbean islands and South-America, growing as a dominant species in swamp forests. This legume is able to fix atmospheric nitrogen through symbiosis and naturally enriches the soil with nitrogen for the benefit of understorey crops. In Guadeloupe, it is under this type of forest cover that taro *(Colocasia esculenta)* monoculture is practised, without inputs. To understand the role of symbioses in this traditional sustainable farming system, researchers identified the symbiotic bacteria associated with *P. officinalis*. While they all belong to the genus *Bradyrhizobium*, they differ markedly in terms of species depending on whether they are found on islands or on the continent. The researchers also showed that combinations of P. officinalis origins and *Bradyrhizobium* strains of the same geographical origin were the most efficient in terms of nodulation, nitrogen fixation and biomass production. The capacity of *Pterocarpus* to transfer the nitrogen fixed to benefit taro, through the mycorrhizal networks shared between the two associated species, is now being studied in the field.

Microbial Ecology, August 2014. Doi: 10.1007/s00248-014-0392-7

Pterocarpus officinalis/taro agroforestry system in marshland forest, Guadeloupe © E. Saur, University of the West Indies and French Guiana (UAG)

PARTNERS
France > Institut de recherche pour le développement (IRD); Ministry of Ecology, Sustainable Development and Energy; University of the West Indies and French Guiana.

CULTIVATED COTTON
BACK TO ITS ROOTS

geo.coppens@cirad.fr
(Genetic Improvement and Adaptation of Mediterranean and Tropical Plants - UMR AGAP)

The genetic diversity of the wild ancestors of cultivated crops has major potential for their improvement in response to global challenges. Identifying worthwhile characters requires prior characterization and conservation work. In the case of cotton *(Gossypium hirsutum),* which originated in the Caribbean and the Gulf of Mexico, this task is complicated by the existence of feral populations derived from ancient domesticated forms that persist in manmade landscapes. By combining ecological and genetic approaches, researchers have shown that despite their dispersion, the wild populations in this region form a homogeneous whole: they are linked to very arid coastal environments and have remained distinct from the feral populations, which are more similar to cultivated varieties. The results confirmed the hypothesis that they were spread by sea currents and that they were domesticated in Yucatan, and subsequently disseminated throughout Mexico. They will make it possible to organize vitally needed operations to conserve wild and feral forms.

PLoS One, 9: e107458 (19 p.). Doi : 10.1371/journal.pone.0107458

SEQUENCED GENOMES

Tilapia > The genomes of five species of cichlids, the family that includes tilapia, were recently sequenced and compared by the CGC (Cichlid Genome Consortium), of which CIRAD is a member. Of the 27 laboratories that co-signed the article in *Nature*, CIRAD, the University of Stirling (UK) and the Agricultural Research Organization (Israel) are particularly interested in the consequences of the project for aquaculture. They will be using the tilapia reference sequence in order to speed up the identification of sequences linked to worthwhile characters and in breeding programmes.

Nature, 18 September 2014. 513 :375-381

jean-francois.baroiller@cirad.fr
(Integrated and Ecological Intensification for Sustainable Fish Farming – UMR INTREPID)

4.3 million tonnes of tilapia are produced each year in more than 100 countries

Coffee > An international study coordinated by researchers from the CEA (Genoscope), CIRAD, the CNRS, the IRD and the University of Buffalo (USA), involving many laboratories, has identified for the first time a reference for coffee. The discovery is doubly interesting: firstly for fundamental reasons, as it improves our understanding of how the genome is structured, functions and evolves, and for more specific reasons, since it opens up new prospects for breeding or improving coffee varieties.

Science, 5 September 2014. Vol. 345 no. 6201 pp. 1181-1184. doi: 10.1126/science.1255274

benoit.bertrand@cirad.fr (Plant-Microorganism-Environment Interactions - UMR IPME)
gaetan.droc@cirad.fr (Genetic Improvement and Adaptation of Mediterranean and Tropical Plants – UMR AGAP)

PARTNERS
France > ANR; Bioversity International; CEA; CNRS; INRA; IRD; Montpellier SupAgro; Nestlé R&D; UM2; University of Evry.

2.25 billion cups of coffee are drunk worldwide every day

Citrus > Under the umbrella of the International Citrus Genomics Consortium, scientists the world over joined forces to decipher the genome of some ten citrus species and this reconstitute the history of the many crosses between them. The initial task was to establish the genomic sequence of the nine chromosomes of a citrus fruit. CIRAD was behind the choice of a haploid clementine (with just one of each chromosome), which simplified analyses. It also coordinated* the establishment of the reference genetic map.

Nature Biotechnology, 8 June 2014. 32, 656-662 (2014). doi:10.1038/nbt.2906

patrick.ollitrault@cirad.fr (Genetic Improvement and Adaptation of Mediterranean and Tropical Plants – UMR AGAP)

*Within the framework of the Citrusseq project, funded by the ANR and conducted in partnership by the Genoscope (CEA), CIRAD, INRA and IVIA.

NATURAL RUBBER PRODUCTION
ETHYLENE, A VITAL HORMONE

pascal.montoro@cirad.fr
(Genetic Improvement and Adaptation of Mediterranean and Tropical Plants – UMR AGAP)

Natural rubber production is closely controlled by ethylene, which is involved in the regulation of various cellular processes. This plant hormone, which is naturally synthesized by the bark tissues, can be brought in from outside through ethephon application for some Hevea clones with low latex metabolism. A detailed analysis of the ethylene signalling pathway pinpointed the key regulators of vital functions in the laticifer metabolism, such as antioxidants and sugar fermentation at low oxygen levels, to maintain biosynthesis of cis-1,4 polyisoprene chains under stress conditions. This knowledge opens the way for the development of functional markers for molecular breeding and of new types of production stimulants

PLoS One. 2014. 9(6):e99367). Doi: 10.1371/journal.pone.0099367

PARTNERS
Belgium > Société Financière des Caoutchoucs (SOCFINCO).
China > Beijing Institute of Genomics, Chinese Academy for Tropical Agricultural Sciences.
France > Institut Français du Caoutchouc; Michelin; Société internationale de plantation d'hévéas (SIPH).
Indonesia > Rubber Research Institute of Indonesia.
Thailand > Rubber Research Institute of Thailand.

© P. Montoro/CIRAD

CLIMATE AND VARIETY LOSSES
FARMERS' MEMORIES

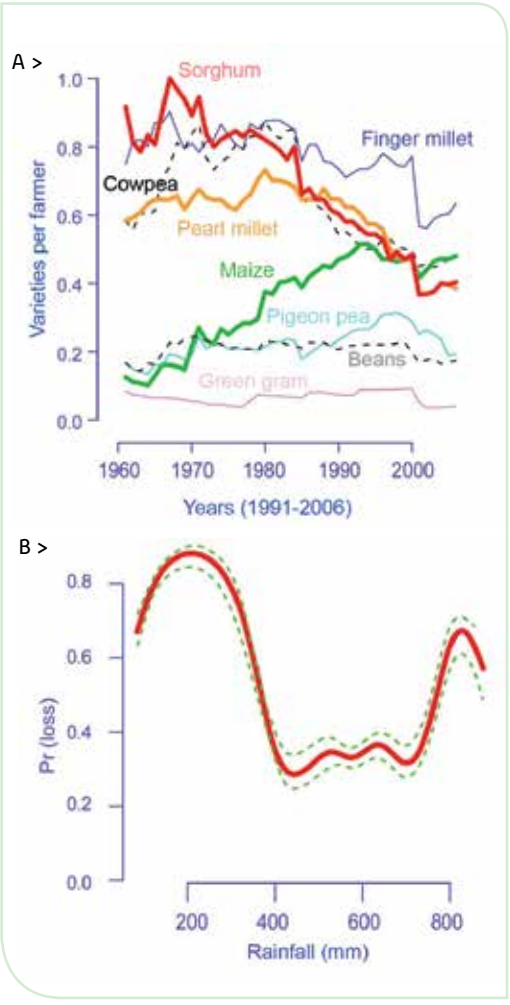
christian.leclerc@cirad.fr
(Genetic Improvement and Adaptation of Mediterranean and Tropical Plants - UMR AGAP)

By asking 208 Kenyan farmers what they could remember, it was possible to trace the evolution of their cropping system, which favoured maize at the expense of sorghum and millet (Fig. 1a), and to measure the effect of climate variations on variety losses for eight major food crops species, between 1961 and 2006. Comparing these data with weather records served to assess the reliability of farmers' memories, particularly as regards extreme climatic events (insufficient or excessive rainfall), and to conduct a retrospective study of the link between climate and variety losses. This showed that the probability of losing a variety increased sharply when the number of days' rain was below 28 or over 40, and total rainfall was less than 400 mm or more than 750 mm (Fig. 1b). Lastly, a species-by-species analysis explained how the system favouring maize increased the risk of seed losses, making the cropping systems of east Africa more vulnerable to climate variations.

Weather, Climate and Society. 2014. 6(3): 354–370.

PARTNERS

France > Agence nationale de la recherche (ANR), Picrevat project; Centre européen de recherche et d'enseignement en géosciences de l'environnement (CEREGE); Centre de recherches de climatologie (CRC); Laboratoire d'océanographie et du climat: expérimentations et approches numériques (Locean)/ University of Burgundy; Montpellier SupAgro; Institut de recherche pour le développement (IRD).



Retrospective analysis of farmers' knowledge.
A. Cropping system dynamics from 1961 to 2006);
B. Probability of variety loss as a function of rainfall

SUGARCANE
ESTIMATING YIELDS FROM SMALLHOLDINGS BY REMOTE SENSING

julien.morel@cirad.fr (Agro-ecology and Sustainable Intensification for Annual Crops - UPR AIDA)

Sugarcane stems: leaf area can be estimated using remote sensing data
© J. Morel/CIRAD

In the smallest sugarcane producing countries, cropping practices are many and varied and there are a multitude of plots. In such conditions, it is difficult to estimate production, even though this is a prerequisite for the sustainability of sugar supply chains. Researchers compared several methods of estimating production based on the vegetation indices supplied by satellites, and observed that the empirical method was the most accurate. They therefore recommend it for use in the smallholder sector. However, with this method, it is vital to have a sufficient number of satellite images to describe the change in the vegetation index over time correctly. The arrival of Sentinel-2 satellites, which supply free-access images with a spatial resolution of 10 metres and an acquisition frequency of five days, should overcome this constraint.

Remote Sensing, 6: 6620-6635. Doi: 10.3390/rs6076620

PARTNERS

France > Institut de recherche pour le développement (IRD); Syndicat du sucre de la Réunion.

Research and training platform in partnership (PP)

PRODUCTIVE, ECOLOGICAL FARMING SYSTEMS IN WEST AFRICA

In the grassland zones of West Africa, people are highly dependent on agriculture, but successive economic, food and climate crises are increasing poverty among farmers. The ASAP* platform in partnership centres on ecological intensification, with the aim of boosting the productivity of sustainable family farming systems combining polyculture and pastoralism.

Souleymane Ouedraogo is a researcher with the Institut de l'environnement et de recherches agricoles (INERA). He has been a member of the ASAP steering committee from the outset. He coordinates the activities of INERA researchers within the platform.

osilamana@yahoo.fr

CAN YOU TELL US A BIT ABOUT THE ASAP PLATFORM?

Souleymane Ouedraogo: While the regional platform, based in Burkina Faso, was not officially founded until 2010, a network of scientists interested in agricultural production systems had been working for several years on a range of projects initiated by CIRAD, particularly the DURAS project promoting sustainable development within agricultural research systems in the South. ASAP is now focusing on ecological intensification issues: how can we design sustainable family farming systems for West Africa? Burkina Faso, Mali, Senegal, Niger, and more recently Ivory Coast, have been associated with our scientific activities within ASAP.

WHAT ARE THE ISSUES?

S.O.: The main task is to boost productivity to ensure food security and adequate incomes for farmers. Designing more productive farming systems inevitably means taking account of the environment, which has driven ASAP to focus on ecological intensification processes. We are working on three scales: plot, farm and territory. Our strategies are based on reducing synthetic input use, better coordination of crop and livestock farming, and taking account of local know-how when designing innovations, in collaboration with farmers.

WHAT ADDED VALUE IS CIRAD PROVIDING?

S.O.: We have been working with CIRAD for a long time. Our partnership has served to bring together researchers working in a shared field, which has forged links. It has also enabled scientists from different fields to work together, and this is an asset. This scientific platform is an ideal framework in which to train students. ASAP gives us greater visibility as regards other organizations, and enables us to attract other stakeholders, obtain resources more easily and build new bridges.

* ASAP: Agro-silvo-pastoral systems in West Africa

Picture painted to order for the ASAP PP
© Mahamoudou Zinkone

PARTNERS

Burkina Faso > Centre International de Recherche-Développement sur l'élevage en zone subhumide (CIRDES); Institut de l'environnement et de recherches agricoles (INERA); Institut d'économie rurale (IER); Polytechnic University of Bobo-Dioulasso: Institut de Développement Rural (UPB/IDR).

France > CIRAD (Joint Research Units: Innovation; Selmet; AGAP; Internal Research Units: AÏDA; BSEF).

BIOMASS AND NON-FOOD USES

© G. Chaix/CIRAD

NATURAL DURABILITY OF TEAK
A RAPID FORECASTING TECHNIQUE

nadine.amusant@cirad.fr
(Ecology of the Forests of French Guiana - UMR ECOFOG)

Teak is appreciated for its exceptional technological properties, particularly its decay resistance. Researchers recently developed a rapid technique for analysing wood and assessing its natural durability by measuring the quinones it contains. The natural durability of teak is the result of the presence of molecules synthesized during heartwood formation, particularly molecules from the quinone family. The quinone content of wood, determined using diffuse reflectance near infrared spectroscopy (NIRS), can therefore be used to predict its natural durability. This indirect, rapid assessment of teak wood decay resistance can be done directly using sawdust. If used with a view to improving wood service quality for stakeholders in the sector, it will make it possible to log and use wood more rationally. The end result will be sustainable logging operations and planting material bred for wood quality.

Journal of Near Infrared Spectroscopy, 22 : 35-43.
Doi: 10.1255/jnirs.1091

PARTNERS

Ivory Coast > Institut national polytechnique Félix Houphouët Boigny; Société de développement forestier (SODEFOR).

Malaysia > Yayasan Sabah Group.

Motorization is a factor for rural development © D. Litvine

AGRIFUELS IN BURKINA FASO
LOCAL SUPPLY CHAINS ARE STIMULATING DEMAND

marie-helene.dabat@cirad.fr
(Actors, Resources and Territories in Development - UMR ART-DEV)

laurent.gazull@cirad.fr
(Tropical Forest Goods and Ecosystem Services - UPR BSEF)

In 2007, Burkina Faso embarked upon production of jatropha oil, a biofuel that can replace diesel in rural areas. This biofuel, which is produced, processed and consumed within the same rural area, fits into the way in which local people live, has stimulated energy demand, and has also changed public opinion. These are the results of a field survey by a team from CIRAD, aimed at understanding how the proximity of supplies influences demand, and how that demand is built and expressed. Demand is generally studied based on technical, economic and demographic factors. It could also be looked at on the basis of subjective, context-related social criteria, which enable an understanding of how consumer preferences are built and adjusted in relation to energy supplies. This novel approach has practical consequences in terms of recommendations to project leaders and decision-makers, and also of establishing strategies of adapting supply to demand that are both viable on a technical level and capable of driving local development.

Ecological Economics, 100: 85-95.
Doi: 10.1016/j.ecolecon.2014.01.018

PARTNERS

Burkina Faso > Institut international d'ingénierie de l'eau et de l'environnement (2iE).
France > University of Montpellier.

Biofuels
Catapult* project

Flash pyrolysis is a thermochemical biomass conversion process that ensures high bio-oil yields. These liquid biofuels offer new prospects for combined matter/energy production using thermochemical biorefining techniques. The aim of the Catapult* project is to improve the quality of the bio-oils produced by using catalysts during pyrolysis, and to assess the relevance of co-production of bio-sourced molecules and alternative fuels. This ANR project relates to both scientific and industrial issues, and spans fields of expertise such as catalyst optimization, development of integrated procedures and product quality analysis/testing.

francois.broust@cirad.fr
(Biomass, Wood, Energy, Bioproducts - UPR BioWooEB)

PARTNERS

France > Agence Nationale de la Recherche (ANR); Céramiques Techniques Industrielles (CTI); Institut de Recherche sur la Catalyse et l'Environnement (Ircelyon – CNRS); Société financière de la filière française des oléo-protéagineux (Sofiproteol).

*Catapult: pyrolytic catalysis for co-production of bio-oils and fuels

SUSTAINABLE FOOD SYSTEMS

Food-consumers
FEWER SENSES, GREATER DISTANCE

Researchers are studying the changes in food consumption in Vietnam. The role of the senses, in particular, influences buying habits.
The modernization of food systems is creating a distance between food and consumers, which can be a source of stress.

Interview with Muriel Figuié, sociologist at CIRAD.

Muriel Figuié (right) on a sensory journey in Vietnam, along with Paule Moustier, Head of UMR MOISA
© M. Figuié/CIRAD

What role do the senses play in food purchases?

Muriel Figuié. In traditional food systems, consumers are used to shopping at open-air markets, and their bodies use all five senses to help them select food: smell and sight serve to rule out rotten or deteriorated or unhealthy food, touch to assess firmness, hearing to exchange information with stallholders and obviously taste to try food. For instance, in Vietnam, chickens are often sold live. Prospective buyers inspect them carefully, looking at the comb, the temperature of the feet, how clean the cloaca is, etc. This gives pointers as to what the bird will taste like, and also to its safety. In supermarkets, which have developed rapidly in Vietnam in the past twenty years, it's a different story. Large stores rely on refrigeration and the cold chain. Any information there is is found on the packaging, which prevents customers touching, smelling and tasting food before they buy. They need to know the different brands and be capable of understanding a list of ingredients or the best before date.

How have Vietnamese consumers adapted to shopping in supermarkets?

M.F. To begin with, it was common to find bags of vegetables that had been torn open by customers who wanted to smell and touch them. Another significant example is the customer who read the best before date on a pack of pork and said "I don't want to know when I have to eat it, I want to know when the pig was slaughtered, and I'll decide!". Best before dates are a new concept in a country where fresh products are generally bought daily. They reflect a shift in expertise and decision-making power from buyer to seller, despite the fact that confidence in the food chain has hit a new low following a series of food crises (contaminated milk, bird flu, etc).

You say that the modernization of food systems is creating a distance between food and consumers. Can you explain what you mean?

M.F. In fact, there is a physical distance between production and consumption sites and as a result of product packaging, a cognitive distance since food is now the result of increasingly complex industrial procedures that consumers know little about, and a social distance, as it is more difficult to associate foods with familiar figures (producers, traders, etc). We maintain that this distance between people and their food is unsettling and stressful. It most probably exacerbates consumers' concerns about food safety. These fears mean that consumers in Vietnam are now turning to imported goods. Our team is looking at how local producers can reclaim the market and thus benefit from growing urban demand for food products, primarily among the emerging middles classes. This research fits in with a research and training platform in partnership, MALICA (Markets and Agriculture Linkages for Cities in Asia).

muriel.figuie@cirad.fr
(Markets, Organizations, Institutions and Stakeholders' Strategies - UMR MOISA)

Figuié M., Bricas N. 2014. Purchasing food in modern Vietnam: when supermarkets affect the senses. *Anthropology of Food:* 12 p. http://aof.revues.org/7445

With the modern food sector, consumers need to rebuild their confidence in what they eat: they have to relinquish direct sensorial inspection and rely on indirect signs (brands, labelling, veterinary service stamps, etc).

URBAN MARKET GARDENING IN VIETNAM
SANITARY QUALITY MEANS PROVIDING TECHNICAL ADVICE

paule.moustier@cirad.fr
(Markets, Organizations, Institutions and stakeholders' Strategies - UMR MOISA)

Collective action on the part of producers can play a vital role in food product quality. Its efficacy was studied recently with respect to market gardeners in the Hanoi region, Vietnam, by researchers from CIRAD, INRA and their partners. Their conclusions confirm those of previous work: the technical training given to members by producers' associations plays a determining role in ensuring food sanitary quality. Of the sixty groups tested, ten showed a level of toxicity that exceeded the authorized values for at least one of their samples. It was the technical advice given to the members of the group by their more experienced peers that most affected product sanitary quality. The institutional and economic environment had little effect, while education favoured increased use of chemicals. Until producers have reached a certain level of knowledge of chemical use, incentives, whether they concern specific outlets, control or labelling, will be largely ineffective.

Journal of Development Studies, 50 : 715-730. Doi : 10.1080/00220388.2013.874555

It is technical advice that most affects product sanitary quality © P. Moustier/CIRAD

PARTNERS. France > Institut national de la recherche agronomique (INRA). United Kingdom > Natural Resources Institute (NRI). **Vietnam >** Fruit and Vegetable Research Institute (FAVRI); Vietnam Academy of Agricultural Sciences (VAAS).

COOKED RICE
A MODEL TO PREDICT TEXTURE

aurelien.briffaz@cirad.fr **christian.mestres**@cirad.fr
(Integrated Approach to Food Quality - UMR QUALISUD)

The way rice is cooked determines its texture (including stickiness and firmness) which is a very important sensory attribute for the consumer. Modelling and predicting all the underlying transfers and reactions occurring during rice cooking and explaining its texture is a relevant strategy to predict and control cooked rice hedonic value. A team from CIRAD has developed a rice cooking model, which considers the grain as a sphere and simultaneously describes water transport, coupled with local deformation and starch gelatinization. This work was original in that it directly related simulation property distributions (water content, degree of starch gelatinization) within the grain with experimentally collected texture data. From a practical point of view, the model could be used to design innovative rice cookers that could propose different cooking modes fitting consumers' expectations.

Journal of Food Engineering, 141: 99-106. Doi: 10.1016/j.jfoodeng.2014.05.008

Rice field in Laos © D. Sautier/CIRAD

PARTNER
France > Montpellier SuPAgro.

PLANTAIN BANANAS
SUITABILITY FOR COOKING AND NUTRITIONAL QUALITY

olivier.gibert@cirad.fr
(Integrated Approach to Food Quality - UMR QUALISUD)

Plantain bananas are a staple food for many people in Africa and Latin America. They are eaten cooked, and when at the fully green stage of maturity, they are rich in starch, their main unavailable carbohydrate macromolecule. A team from CIRAD is looking into the technological properties of these bananas, which determine their processability and uses, with a view to optimizing their quality, particularly nutritional, once cooked. The researchers showed that in the case of green plantain bananas, even if the starch was 100% gelatinized, it was not 100% digestible and that temperature is thus the determining factor in starch conversion and its digestibility. They also revealed major differences between genotypes in how firmness changed during boiling. Those differences, which can largely be put down to the degree of starch gelatinization, can be used to pinpoint the genotypes consumers are likely to prefer. The researchers also looked at the change in plantain banana nutritional quality when boiled. To this end, they used digital modelling tools to compile a phase diagram that predicts the digestibility of that starch in green plantain bananas depending on its degree of gelatinization, processing temperature and water content during cooking.

Different plantain bananas from the collection held by CARBAP (African Research Centre on Banana and Plantain) in Cameroon
O. Gibert © CIRAD

PARTNERS
Cameroon > African Research Centre on Banana and Plantain (CARBAP). **Colombia >** International Center for Tropical Agriculture (CIAT). **France >** Montpellier SupAgro. **Mexico >** Instituto Politecnico Nacional. **Venezuela >** Central University of Venezuela.

Agrociencia, 48 : 387-401. http://www.colpos.mx/agrocien/Bimestral/2014/may-jun/art-4.pdf

Microorganisms and fermentation of traditional food products

Fermentation is seen as one of the oldest food and drink processing technologies, and gives them a longer shelf life and better organoleptic properties. The most common groups of microorganisms involved in food and drink fermentation are bacteria, yeasts and moulds. The role of fermented foods in human health and wellbeing has attracted interest recently, and there is much discussion of the contribution of probiotic bacteria, which include lactobacillus species.

This first volume in a trilogy of books comprises eleven chapters written by 19 international experts, and covers the history and current knowledge of and prospects for fermented foods. The last chapter addresses the food safety aspects of traditional fermented foods.

didier.montet@cirad.fr
(Integrated Approach to Food Quality - UMR QUALISUD)

Microorganisms and fermentation of traditional foods
CRC Press, August 2014

Making traditional sweets on a market in Ayutthaya, Thailand
G. Trébuil © CIRAD

ANIMAL AND PLANT HEALTH

Integrated insect management

"IT IS ESSENTIAL TO CONSIDER THE WHOLE SYSTEM"

Jérémy Bouyer
next to a tsetse fly trap
© J. B.

Two entomologists, Jérémy Bouyer, a veterinarian, and Thierry Brévault, an agronomist, are attempting to establish a single set of conditions for ensuring effective integrated pest management. Intelligent pest control means taking account of the system as a whole, from the biological and ecological processes involved to the ways in which stakeholders in the region concerned make decisions.

You recently co-signed an article, yet you don't work together. What was the idea behind it?

Thierry Brévault. Jérémy is a veterinarian and I'm an agronomist. But our research overlaps when it comes to controlling insects that damage crops or carry diseases. With this article, we wanted to state clearly that integrated pest management will not be effective unless the system as a whole is taken into account. This means determining a functional area (pest population or production basin) and knowing more about the ecological processes involved in regulating populations of the target pest in that area and also the stakeholders concerned and the way in which they make decisions.

According to you, it is essential to know more about the ecological processes that regulate pest populations. Give us an example...

Jérémy Bouyer. We recently took part in the successful eradication of tsetse flies in part of the Niaye region of Senegal. Tsetse flies carry animal trypanosomosis, a disease that is seen as the main obstacle to the development of livestock farming in sub-Saharan Africa. The campaign, which centred on integrated management, combined fly trapping, treating livestock with insecticides and aerial releases of sterile male flies during the eradication phase. To ensure effective control, it was firstly necessary to pinpoint the fly population and determine its ecological dynamics. After three years of studies of these processes, we were able to target the tsetse flies' preferred habitats. This knowledge served both to cut costs and ensure that the eradication campaign was fully effective.

14% of agricultural output is lost before and after harvesting, due to pests! Integrated management is the only method with a future, at a time when pesticides have been seen to be a danger to health and the environment and are becoming less and less effective.

Thierry Brévault © T. B.

Why is it also vital to take account of the stakeholders in the system in order to control pests?

T.B. Because if you look at things on a broader scale than just the cultivated plot, you quickly realize that as insects know no borders, several stakeholders are concerned. If a farmer has simple techniques for controlling a given pest in his field, for instance insecticide applications, the field will probably become reinfested unless steps are also taken to control the pest in neighbouring fields. Likewise, if some farmers treat their fields with broad spectrum insecticides, they will fail to conserve the natural enemies that act to regulate populations of the target pest. The whole socio-ecosystem must therefore be taken into account. Hence the need to work collectively and for effective coordination. Implementing integrated pest management strategies often means reaching a consensus, and consultation is therefore essential.

J.B. Moreover, the reality in the field has shown us that integrated management is often not used effectively: it is seen as a simple toolbox and only used very locally. We recommend a fundamental change in approach to ensure more effective preventive management of pests and vectors. To this end, it is essential that we involve all the stakeholders in a region and train farmers so as to pass on our knowledge of the ecological dynamics of pest populations and make them aware of the need for concerted collective action.

jeremy.bouyer@cirad.fr
(Control of Exotic and Emerging Animal Diseases - UMR CMAEE)

thierry.brevault@cirad.fr
(Agro-ecology and Sustainable Intensification for Annual Crops - UPR AIDA)

Outlooks on Pest Management, 25 (3): 212-213. Doi: 10.1564/v25_jun_05

Proceedings of the National Academy of Sciences of the United States of America, 111: 10149-10154. Doi: 10.1073/pnas.1407773111

© N. Le Gall

Sheep farm in Senegal © R. Lancelot/CIRAD

POX AND PESTE DES PETITS RUMINANTS
A BIVALENT VACCINE CAPABLE OF OVERCOMING ACQUIRED IMMUNITY

philippe.caufour@cirad.fr
(Control of Exotic and Emerging Animal Diseases - UMR CMAEE)

In Africa, the Middle East and Asia, pox and peste des petits ruminants (PPR) have devastating effects on goat and sheep farms. A bivalent vaccine effective against both pox and PPR was developed recently. However, as is the case with other vaccine vectors, there were fears that its efficacy might be limited by acquired immunity to one of the two diseases in regions where they are endemic. To test this hypothesis, virologists conducted a series of experiments on goats already immunized against one virus or the other. They showed that while the recombinant vaccine protected animals previously infected with the PPR virus against the CaPV virus, the same could not be said for protection against PPR of animals pre-immunized against CaPV: the protection provided by the vaccine against the PPR virus was much lower in these animals. As seen with the main viral vector families, pre-immunity against the CaPV viral vector thus results in a loss of efficacy when using recombinant CaPV in areas where these viruses are found and circulate endemically.

Vaccine, 32: 3772-3779. Doi: 10.1016/j.vaccine.2014.05.025

PARTNERS
Austria > Animal Production and Health Laboratory
Ethiopia > National Animal Health Diagnosis and Investigation Center (NAHDIC)
France > Institut national de la recherche agronomique (INRA)

Endogenous florendoviruses are found in many flowering plants, including rice © J.E. Taillebois/CIRAD

FLORENDOVIRUS
A NEW VIRAL GENUS DISCOVERED IN FLOWERING PLANTS

pierre-yves.teycheney@cirad.fr
(Genetic Improvement and Adaptation of Mediterranean and Tropical Plants - UMR AGAP)

An international team of scientists, some of them from CIRAD, has discovered a new viral genus of which parts of the genome have been captured and maintained in the DNA of flowering plants as molecular fossils. The genus has been named *"Florendovirus"* after the Roman goddess of flowers, and is estimated to have existed for more than 20 million years and to have remained active at least until 6000 years ago. In recent years, analyses of data obtained by genome sequencing programmes have shown that the presence of viral sequences within the genome of higher living organisms is the rule rather than the exception. In flowering plants, a veritable molecular invasion has been discovered recently. Florendoviruses are genuine fossil viruses, and shed light on plant virus evolution processes.

Nature Communications, 5: 5269. Doi: 10.1038/ncomms6269

PARTNERS. Australia > University of Queensland. **USA >** University of Arizona. **France >** INRA-URGI. **Italy >** IGA and Edmund Mach Foundation.

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Grasses being tested as cover crops in a banana planting at the Rivière Lézarde experimental station, Martinique © P. Tixier/CIRAD

WITH OR WITHOUT COVER CROPS
WHO IS EATING BANANA WEEVILS?

pierre-francois.duyck@cirad.fr
(Plant Communities and Biological Invaders in Tropical Environments - UMR PVBMT)]

philippe.tixier@cirad.fr
(Ecological Functioning and Sustainable Management of Banana and Pineapple Cropping Systems - UPR GECO)

Cover crops can foster natural pest regulation by enabling predator populations to thrive. However, they can also significantly modify the diet of those predators. A team from CIRAD recently proved this by identifying the prey eaten by banana weevil predators in plantations in Martinique, using the DNA metabarcoding technique. This was a first in terms of the use of this DNA analysis technique in situ. The study clearly showed that cover crops modified the trophic links between arthropods, notably the diet of the banana weevil's three predators. Although it does not seem to affect predation of the weevil, this modification demonstrates the importance of understanding how the complex network of interactions between organisms within an agrosystem works, and of having the appropriate tools to achieve such an understanding.

PARTNERS. France > Centre for Biology and Management of Populations (UMR CBGP); Institut national de la recherche agronomique (INRA); Montpellier SupAgro

PLoS One, 9: e93740. Doi: 10.1371/journal.pone.0093740

Major results

Two trypanosome genomes have been sequenced

Collaboration with the Genoscope has enabled the sequencing of the genome of two *Phytomonas* (parasitic trypanosomes), one of which causes coconut hartrot and oil palm marchitez in Latin America and the southern Caribbean and the other, which is not pathogenic and was isolated in a *Euphorbia* in the South of France. Twenty-five researchers from 16 organizations in eight countries were involved in the project to conduct a comparative analysis of these sequences in relation to human and animal trypanosomes. The analysis revealed many analogies with the trypanosomes that cause leishmaniasis in animals and humans, but also demonstrated a high degree of adaptation to plants. More detailed studies of the two *Phytomonas* sequences could pave the way for new research into effective, non-polluting treatments against these parasitic diseases of plants.

michel.dollet@cirad.fr
(Plant-Microorganism-Environment Interactions - UMR IPME)

PLos Genetics. 6 February 2014. DOI: 10.1371/journal.pgen.1004007

CONFLICT OR SYNERGY?
FIGHTING EROSION AND CONTROLLING MILLET PESTS

alain.ratnadass@cirad.fr
(Agro-ecological Functioning and Performances of Horticultural Cropping Systems - UPR HORTSYS)

Soil erosion is a major problem in the Sahel. On sandy soils, wind erosion can also damage fields of millet, the region's main food crop. To limit these adverse effects and maintain soil fertility, millet stalks can be left in the field after harvesting. But how does this practice affect millet pest survival? Researchers recently studied those effects at two sites in Niger. They observed that cutting millet stalks on harvesting and stocking them on platforms created the most favourable conditions for stem borer larva survival. However, survival rates were lower if the stalks were laid on the soil. In the case of panicle pests, using harvest residues to reduce erosion and maintain soil fertility does not help regulate pest populations. In the case of stem borers, it is even in conflict with pest control, since it allows its larvae to survive.

PARTNER. Niger > Centre de multiplication des semences de Doukou-doukou; International Crops Research Institute for the Semi-Arid Tropics (ICRISAT); Institut national de recherches agronomiques du Niger (INRAN); Abdou Moumouni University.

Agriculture Ecosystems and Environment, 186: 144-147. Doi: 10.1016/j.agee.2014.01.021

This study was conducted under the Bill and Melinda Gates Foundation Hope for Dryland Cereals project.

Sieving soil samples to determine the soil microfauna in millet plots
© A. Ratnadass/CIRAD

FRUIT CROPS IN RÉUNION
NEW FRUIT FLY TRAPS

serge.quilici@cirad.fr
(Plant Communities and Biological Invaders in Tropical Environments - UMR PVBMT)

Female *Ceratitis rosa* fruit fly
© D. Vincenot/Chambre d'Agriculture de la Réunion

In Réunion, researchers from CIRAD and their Spanish counterparts have helped develop a system for the mass trapping of female fruit flies of two species, *Ceratitis rosa* and *C. capitata,* which cause significant damage. The system, which combines a trap, a substance that attracts the females and a small amount of insecticide, is easy to use and as effective as conventional control methods, but without the drawbacks. It requires very small quantities of insecticide, and only in the traps, with no products applied to the fruit It is easy to use: once the traps are installed, the attractant and the insecticide remain active through the period during which the fruits are susceptible, and the traps are not removed until the end of the season. It removes the need for repeated spot treatments with spinosad, which could, in the medium term, lead to the appearance of resistance in the flies. It is ideal for protecting citrus orchards at medium and high altitudes.

PARTNERS. Spain > Institut de Recerca i Tecnologia Agroalimentàries (IRTA). **France >** Association réunionnaise pour la modernisation de l'économie fruitière, légumière et horticole (ARMEFLHOR).

Pest Management Science, 70: 448-453. Doi: 10.1002/ps.3591

Faune sauvage, biodiversité et santé, quels défis ?

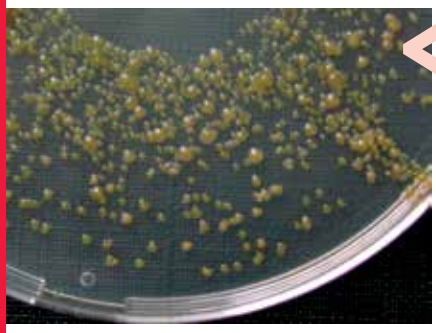
Biodiversity is currently disappearing a hundred times more quickly than it naturally would. Some people are even talking about a sixth great extinction. At the same time, emerging and re-emerging diseases are booming. Might there be links between biodiversity and pathogen transmission? Might biodiversity loss mean health risks? Might antimicrobial resistance be partly responsible? Has wildlife reluctantly become a sentinel of the healthiness of our environment? This book enables anyone curious and concerned about these societal and ecological issues to understand better the interactions between living beings and their environment. It also demonstrates how research is now finding alternatives thanks to a new health ecology approach, for the good of all.

serge.morand@cirad.fr
(Animal and Integrated Risk Management - UPR AGIRS)

Faune sauvage, biodiversité et santé, quels défis ? Editorial coordination: Serge Morand, François Moutou, Céline Richomme. Editions Quae, 2014
CRC Press, August 2014

SUGARCANE LEAF SCALD
VARIETY PLAYS A DETERMINING ROLE IN CONTAMINATION

jean-heinrich.daugrois@cirad.fr (Biology and Genetics of Plant-Pathogen Interactions - UMR BGPI)



Xanthomonas albilineans obtained from droplets on a culture medium
© J.H. Daugrois/CIRAD

In Guadeloupe, the bacterium *Xanthomonas albilineans*, which causes sugarcane leaf scald, is transmitted by air and colonizes the leaf surface before spreading within the tissues. A team from CIRAD recently demonstrated that variety has a determining influence on this early infection stage and on the subsequent evolution of the disease. The researchers observed that from one variety to another, the populations found on the leaves varied substantially, depending on rainfall during the harvesting cycle, as did leaf symptoms. In some sugarcane varieties, high epiphytic population levels resulted in severe leaf symptoms, while in others, similar densities caused few, if any symptoms There are thus various resistance mechanisms that play a role in the multiplication of the bacterium on the leaf surface or within the leaf, or a mechanism that regulates population movements from the leaf surface into the tissues.

Plant Disease, 98: 191-196. Doi: 10.1094/PDIS-02-13-0195-RE

White streaks and necrosis caused by *Xanthomonas albilineans* on a sugarcane leaf
© P. Rott/CIRAD

A NEW INFECTION MECHANISM HAS BEEN DISCOVERED

philippe.rott@cirad.fr (Biology and Genetics of Plant-Pathogen Interactions - UMR BGPI)

The pathogenic bacterium *Xanthomonas albilineans* was thought to multiply solely within the sugarcane vascular system. However, researchers from CIRAD and the IRD recently demonstrated that it can also invade other leaf and stalk tissues. In the leaves, it is found not only in the xylem, but also in the phloem (the tissue that carries the phloem sap), the cells of the vascular and non-vascular parenchyma, and the cells of the epidermis. Within the stalk, the bacterium is found in the cells of the vascular parenchyma and the phloem. More surprisingly, the bacterium was also found in the cells of the non-vascular parenchyma of the stalk (also known as storage cells) and in the intercellular spaces between these cells. This is the first time such a phenomenon has been described in a plant pathogenic bacterium. This discovery opens up new prospects for research into bacterial invasion strategies.

PARTNER
France > Institut de recherche pour le développement (IRD)

Open Biology, 4 (130116): 13 p. Doi: 10.1098/rsob.130116

RAINFED RICE IN MADAGASCAR
USING CONSERVATION AGRICULTURE TO CONTROL BLAST

mathilde.sester@cirad.fr (Agro-ecology and Sustainable Intensification for Annual Crops - UPR AIDA)

In the highlands of Madagascar, upland rice is often affected by blast, a fungal disease that can devastate crops. Does conservation agriculture, which is practised to control erosion in this hill region, affect the development of the disease? Researchers from CIRAD and FOFIFA carried out five years of trials on several upland rice varieties. The results were mixed: while conservation agriculture does reduce the impact of the disease, it also delays growth, which penalizes yields, particularly for the most sensitive varieties. The researchers are now looking into new lines of research aimed at improving crop establishment while preserving the beneficial effects of these systems on disease tolerance.

PARTNER
Madagascar > National Centre of Applied Research and Development (FOFIFA)

Plant Pathology, 63: 373-381. Doi: 10.1111/ppa.12099

Rice blast symptoms on upland rice
© M. Sester/CIRAD

AFRICAN YAMS

BADNAVIRUS SEQUENCES HAVE BEEN DETECTED IN THE GENOME

denis.filloux@cirad.fr (Biology and Genetics of Plant-Pathogen Interactions - UMR BGPI)

CIRAD and INRA, in partnership with the NRI and the IITA, recently revealed the presence of badnavirus viral elements within the genome of African yams of the *Dioscorea cayenensis-rotundata* complex. This is a first for this tuber, which is widely grown in West Africa. Several of those elements, christened eDBVs, for endogenous *Dioscorea* bacilliform virus, have been partly characterized on a molecular level. Their particularly complex structure, which includes highly rearranged, repeated or reversed sequences, is currently being studied in depth. Analyses, notably of plant material grown from seed, also served to identify several yam species that included these sequences. Badnaviruses affect many tropical plants, causing sometimes serious diseases. The question now is whether, as in banana, some of the endogenous elements found in yams could cause spontaneous infection.

PARTNERS. **France >** Institut national de la recherche agronomique (INRA). **Nigeria >** International Institute of Tropical Agriculture (IITA). United Kingdom > Natural Resources Institute (NRI).

Molecular Plant Pathology, 15: 790-801. Doi: 10.1111/mpp.12137

Yams are a vital part of the diet of people in the Tropics, particularly in West Africa
© D. Filloux/CIRAD

Launch of the PACSUN* network

Cassava is under surveillance

The food security of some 700 million Africans depends on cassava, which is playing an increasingly central role, notably following the recent staple food price rises. However, there are two viral diseases that are a dangerous threat to the crop: cassava mosaic disease, which is found throughout Africa and significantly reduces yields, and cassava brown streak disease, which is now present in East Africa and makes cassava unfit for consumption and processing.

To fight these diseases, 28 international organizations recently joined forces to set up the Pan-African Cassava Surveillance Network, PACSUN. The most urgent priority is to monitor and limit the spread of cassava brown streak disease to Central and West Africa, with its potentially huge impact on cassava production.

An international disease-free cassava cutting production and control facility is also due to be set up in Réunion, the only zone free from the two viral diseases in sub-Saharan Africa.

* Pan-African Cassava Surveillance Network

jean-michel.lett@cirad.fr
(Plant Communities and Biological Invaders in Tropical Environments - UMR PVBMT)

© J. Muchnik/CIRAD

The food security of some 700 million Africans depends on cassava

The launch of PACSUN and of an international cassava transit site at the Plant Protection Platform in Réunion is the result of an international workshop on the surveillance and control of cassava diseases in Africa, organized in Réunion from 10 to 13 June by CIRAD and the IRD, under the aegis of GCP21 (Global Cassava Partnership for the 21st Century).

ASIATIC CITRUS CANKER
KNOWING MORE ABOUT THE CAUSAL BACTERIUM

olivier.pruvost@cirad.fr
(Plant Communities and Biological Invaders in Tropical Environments - UMR PVBMT)

Citrus canker, which is caused by the bacterium *Xanthomonas citri* pathovar *citri*, is a major constraint on citrus fruit growing in tropical and subtropical regions and a threat to citrus growing countries in the Mediterranean. Little is known about the genetics of *X. citri* populations, particularly in its area of origin, Asia. However, it is this zone that will be the source of future emerging strains. A genotyping scheme has been established for the epidemiosurveillance of the bacterium. The scheme, which targets minisatellite sequences, is technically easy to implement, and the data obtained can be shared on line on a dedicated website. It has served to identify four major genetic lines for the pathovar citri, relating to their range of hosts within Rutaceae, the botanical family to which citrus fruits belong. One of those lines was almost wholly responsible for the spread of the disease beyond Asia during the first half of the 20th century. The characterization in Iran of previously unknown strains is proof of the scheme's merits for surveillance. It is currently being used to understand the re-emergence of the bacterium in sub-Sahelian Africa.

PLOS ONE. Doi: 10.1371/journal.pone.0098129

http://www.biopred.net/MLVA/
http://www.efsa.europa.eu/en/efsajournal/pub/3556.htm

Citrus canker on a fruit © O. Pruvost/CIRAD

PARTNERS

France > Agence nationale de la recherche (ANR); Centre national de la recherche scientifique (CNRS); Réunion Regional Council; European regional Development Fund (ERDF); Institut de recherche pour le développement (IRD); University of Paris-Sud.

Animal and zoonotic diseases

Europe and China launch LinkTADs

Animal product output in China has quadrupled in twenty years, and livestock farms have become much more intensified. This situation raises issues as regards the surveillance and control of animal and zoonotic diseases, such as avian influenza or African swine fever. The recent emergence of ASF in Russia has prompted fears of its arrival in Western Europe in the near future and subsequently in China. The fight against ASF clearly illustrates the need for collaboration and coordination between Europe and China. It is against this backdrop that LinkTADs, a research consortium funded by the European Union and backed up by the FAO, whose epidemiology operations are led by CIRAD, was launched recently.

julien.cappelle@cirad.fr
(Animal and Integrated Risk Management – UPR AGIRS)

PARTNERS. European Commission, FAO. China > Beijing Chinese Center for Disease Control and Prevention (CADC); China Animal Health and Epidemiology Center (CAHEC); Harbin Veterinary Research Institute (HVRI); Huazhong Agricultural University (HZAU); Shanghai Veterinary Research Institute (SHVRI). **Hungary >** Europa Media Non-profit Ltd. (EM). **Portugal >** Sociedade Portuguesa de Inovação (SPI). Sweden > National Veterinary Institute (SVA). **United Kingdom >** Royal Veterinary College (RVC).

http://ur-agirs.cirad.fr/projets/linktads

China, number one in the world animal product production and consumption rankings

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Infectious diseases

"BAT DISTRIBUTION IN AFRICA AFFECTS THEIR VIRAL DIVERSITY"

A recent study published in *PLoS One* showed that the fragmentation of the distribution area of African bats is a factor in their viral diversity. These results will enable a better understanding of the role of Chiroptera in the circulation of viral diseases such as Ebola, Marburg or rabies.

Interview with Mathieu Bourgarel, ecologist at CIRAD.

To understand better the role played by bats in virus circulation in Africa, you sought to pinpoint the factors that determine the viral diversity of these animals. What results did you obtain?

Mathieu Bourgarel. Quite unexpectedly, the size and weight of animals are both significant factors. However, what is more surprising is that a high degree of fragmentation of the distribution area increases the range of viruses found within a given bat population. As I recall, the idea of testing this criterion was mooted during a discussion with two of my colleagues, but we really weren't expecting it to be that important! This result should set a precedent. From now on, scientists working on viral diversity among wild animals will undoubtedly take account of the distribution area. Along with rodents, Chiroptera represent the majority of mammals on Earth. The two groups are largely responsible for infectious disease circulation, yet there have been ten times more studies of rodents than of bats.

Encounter with a *Rousettus Ægyptiacus* bat (Zadie Cave, Gabon)
© J.-L. Albert

Data were gathered for 15 species (eight Pteropodidae or fruit bats and seven Microchiroptera) in central and West Africa. How did you go about this?

M.B. Field data were supplemented with a vast operation to gather bibliographical data. We compiled studies drawn from the scientific literature and also databases held by the International Union for Conservation of Nature on the distribution of animal species. Based on this synthesis, a database was compiled with, for each population, information on its morphological, ecological and behavioural traits. This collective work was facilitated by numerous partnerships, notably with the IRD, the International Medical Research Centre in Franceville (Gabon) and the Institute of Virology in Bonn (Germany).

How can you explain your results?

M.B. All the possible explanations are merely hypotheses for the moment. We will need other studies in order to confirm or invalidate them. The link between fragmentation of the distribution area and the viral diversity of a population is the result of numerous factors, including co-evolution phenomena between viruses and bats. Moreover, a fragmented distribution area may mean a range of habitats, hence Chiroptera may be in contact with a wider range of viruses. To test these hypotheses, we first of all need to understand the driving factors behind the fragmentation of the distribution area of an animal species, particularly as the correlation is not systematic. For instance, in Southeast Asia, a similar study of bats has shown a converse pattern. This difference may be due the fact that there are fewer natural habitats in Asia than in Africa.

"The correlation between the fragmentation of the distribution area of bats and their viral diversity was a pleasant surprise"

mathieu.bourgarel@cirad.fr
(Animal and Integrated Risk Management - UPR AGIRS)

Maganga G. *et al.* 2014. *Bat distribution size or shape as determinant of viral richness in African bats.* PLoS One, 9: e100172. Doi: 10.1371/journal.pone.0100172

Gay N. *et al.*, 2014. *Parasite and Viral Species Richness of Southeast Asian Bats: Fragmentation of Area Distribution Matters.* International Journal for Parasitology. Parasites and Wildlife 3 (2). Australian Society for Parasitology: 161–70. doi:10.1016/j.ijppaw.2014.06.003.

PUBLIC ACTION FOR DEVELOPMENT

Payments for environmental services (PES)

RESTORING FORESTS WHILE REDUCING INEQUALITIES

A study compared the efficacy, cost effectiveness and equity of two types of payments for environmental services (PES). The results suggested that provided PES are tailored to the differing realities of farms, they are capable not only of restoring ecosystem services but also of alleviating poverty.

Interview with Damien Jourdain, economist at CIRAD.

You compared two types of payments for environmental services (PES). Tell us about them.

Damien Jourdain. The initial idea behind PES was to make a payment per unit of forest land that was supposed to correspond to the ecological services rendered. In practice, the payments are decided based on an average opportunity cost for land in hilly areas and the budgetary capacity of the programme concerned. In mountain areas of Southeast Asia, it is easier for the farmers who manage the most land, particularly irrigated, to participate. We wanted to find a way of overcoming the obstacles that prevent smallholders getting involved. Their small areas and limited access to water force these farmers to use cropping methods that foster erosion and push them to clear more land due to the poor yields obtained. Based on these observations, we compared a conventional PES (PFF for Payments For Forests) with a PES that included support to build terraces and irrigate plots (TFF for Terraces For Forests). The results of our simulations showed that these TFF programmes boosted the participation of the poorest farmers and ensured more reforested zones per euro invested than PFF-type PES.

You used agricultural modelling to analyse payment for environmental services programmes. What did this consist in?

D.J. First of all, we conducted field surveys and diagnoses of farms in a mountain region in northern Vietnam. We compiled a quite detailed database with information such as the number of hectares, the main constraints, cropping systems, inputs used, yields, access to credit, etc. When inputted into a model, this information enabled us to simulate the possible options for farmers wanting to optimize their activity. The model was calibrated to resemble the field reality. We were able to simulate the impact of the two types of PES and compare them as per two criteria: equity and cost effectiveness. The results were clear: the TFF-type programme was more effective on both counts. By maintaining the two types of PES, we could design a win-win programme that would serve both to expand the area under forest and alleviate the inequalities between farming families.

Is taking account of equity in studies of PES a novel concept?

D.J. Not really. However, while many studies have been critical, very few have come up with more equitable alternatives. The innovative aspect of our work was to make available several types of PES that may suit the multiplicity of farms in the mountain areas of Southeast Asia. In this case, PFF programmes are intended for large cultivated areas and TFF for smallholdings. I feel it is important to maintain these two types of PES so that as many farmers as possible have access to them. Our article shows that different PES programmes tailored to the actual agricultural context could succeed not only in restoring ecosystem services but also in alleviating poverty.

damien.jourdain@cirad.fr
(Water Management, Stakeholders and Uses - UMR G-EAU)

Jourdain D. *et al.*, 2014. *Water for forests to restore environmental services and alleviate poverty in Vietnam: A farm modeling approach to analyze alternative PES programs.* Land Use Policy, 41: 423-437. Doi: 10.1016/j.landusepol.2014.06.024

The innovative idea is to propose several types of payments for environmental services suited to the multiplicity of farms.

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PES

ARE THEY INSTRUMENTS THAT COMMODIFY NATURE?

alain.karsenty@cirad.fr
(Tropical Forest Goods and Ecosystem services - UPR BSEF)

Payments for environmental services are often presented as «market-based» instruments, since they modify incentives, although recourse to genuine markets is exceptional. While it is essentially property rights that are exchanged on a market, this is not the case with most payments for environmental services, in which land use rights are suspended by contract but not transferred. This is the theory put forward by two CIRAD researchers in a book published recently. According to them, the market concept is used metaphorically as much by «all-market» partisans, to discredit regulations, as by their adversaries, who liken financial incentives to «markets», without either party explaining the concept of market they are using. While the authors rule out the idea of the commodification of nature, they do stress the risks surrounding the potential extent of biased nature conservation motives (financial interests) were such payments to become widespread.

PARTNER. France > GRET

L'instrumentation de l'action publique. Paris: Presses de Sciences Po, p. 161-189.

PESMIX project

International workshop in Montpellier

As part of the PESMIX* project, CIRAD, the CDC mission on the economics of biodiversity and their partners, with the support of the Languedoc-Roussillon regional Council, organized an international workshop from 11 to 13 June 2014 on how to coordinate payments for environmental services with other political and economic instruments in both North and South. More than 100 participants from all over the world took stock of the conceptual debate on PES, the main feedback on the implementation of the instrument and the prospects for development.

alain.karsenty@cirad.fr
(Tropical Forest Goods and Ecosystem Services - UPR BSEF)

http://pesmix.cirad.fr/atelier-2014

* PESMIX is a research project funded by the ANR and the IRD. It centres on the integration of PES mechanisms into environmental policy instruments in Mexico and Madagascar.

Agricultural landscape, Sulawesi, Indonesia
© B. Locatelli/CIRAD

A «multi-level» simulation support for use in the form of a game, computer model or foresight workshop, to allow ongoing exchanges between different types of players. © P. D'Aquino/CIRAD

RESOURCE MANAGEMENT IN SENEGAL
PARTICIPATORY DEVELOPMENT OF COLLECTIVE RULES FOR NATURAL RESOURCE AND LAND MANAGEMENT

patrick.d'aquino@cirad.fr (Management of Renewable Resources and Environment - UPR GREEN)

Although participatory approaches are increasingly recognised as necessary for involving local people in resource and land management, their impacts often remain limited in the long term, whether at the local level or on broader scales. Based on this observation, Researchers from CIRAD and their Senegalese partners developed a methodology, Self Land Policies, which provides populations with tools for participatory analysis and foresight that they can use on their own, in order to co-develop and simulate their own proposals for territorial management. Self Land Policies are based on a strategic hypothesis: in order to obtain lasting, wide-ranging impacts, stakeholders must be empowered to implement the process as independently as possible, in their local territory but also, more broadly, nationwide. Applied to the management of local territories, and then to the definition of national land and environmental regulations, the impacts of this methodology can still be seen in Senegal 15 years after implementation, on a local and national level.

PARTNERS. Senegal > École supérieure polytechnique; ENDA-PRONAT; Institut sénégalais de recherches agricoles (ISRA); Gaston Berger University.

Journal of Environmental Management, 132: 207-219. Doi: 10.1016/j.jenvman.2013.11.011

In Republic of Congo, the Atama firm's oil palm plantation is expanding at the expense of a Maranthaceae forest that is an ideal habitat for gorillas and elephants © L. Feintrenie/CIRAD

AGROINDUSTRIAL INVESTMENT
RISKS AND OPPORTUNITIES FOR CENTRAL AFRICA

laurene.feintrenie@cirad.fr (Tropical Forest Goods and Ecosystem Services - UPR BSEF)

What are the social, economic and environmental impacts of growing agroindustrial investment in Central Africa in recent years? How can we ensure that it benefits local people and host countries? What standards are required to protect the environment, particularly forests? These questions are crucial for host countries. Their national development strategies give great importance to the agricultural sector, but to benefit from agroindustrial investments they must first regulate land allocation. A CIRAD researcher has looked into the repercussions of these agroindustries in Central Africa, a region that is home to the natural forests of the Congo Basin. Her analysis is based on an assessment of large-scale land acquisitions and on field surveys. The analysis resulted in a certain number of recommendations to help the authorities define and implement land allocation policies that preserve natural resources while fostering sustainable, equitable economic development.

Biodiversity and Conservation, 23: 1577-1589. Doi: 10.1007/s10531-014-0687-5

Brazil © P. Y. Le Gal/CIRAD

DEVELOPMENT COOPERATION
A SECTOR IN TURMOIL

jean-jacques.gabas@cirad.fr . **vincent.ribier**@cirad.fr . **denis.pesche**@cirad.fr
(Actors, Resources and Territories in Development - UMR ART-DEV)

Development cooperation is a field that has traditionally been analysed by economists, who prefer questions regarding the efficiency, performance or selectivity of aid. But it is a sector in turmoil. It is becoming both more complex and more technical, making the aid system and related decisions more opaque: the decisions and changes seen in this field are increasingly difficult to integrate into conventional democratic functioning mechanisms, in which the aim is to be able to account for the policies adopted. The journal *Mondes en Développement* has published a series of articles, directed by researchers from CIRAD and UQAM, detailing a range of new disciplinary approaches and shedding new light on recent developments in this field.

PARTNER. Canada > Université du Québec à Montréal (UQAM).

Mondes en développement, 165: 172 p. Cairn.info

Research and training platform in partnership (PP)

PROMOTING SUSTAINABLE TYPES OF DEVELOPMENT IN AMAZONIA

The "Amazonia" platform federates research operations centring on a specific objective: reconciling the environment and support of rural populations. It aims to provide the scientific expertise required to establish sustainable territorial development while boosting the productivity of family farming systems.

© J. Ferreira/DR

Joice Ferreira works in Belém, at EMBRAPA's eastern Amazonia centre. She is an ecology researcher and is a member of the steering committees of the Amazonia PP and the ECOTERA project, coordinated by CIRAD.

joice.ferreira@embrapa.br

www.accord-biomeamazonien.org

PARTNERS. **Brazil >** EMBRAPA Amazônia Oriental: network of research stations and technicians along pioneer fronts; Roraima centre; Universidade Federal do Para (UFPa): Núcleo de Ciências Agrárias e Desenvolvimento Rural (NCADR) – laboratory for research on and training in family farming in Amazonia; Museo Paraense Emílio Goeldi: environmental modelling; Universidade do Brasilia: Sustainable Development Centre.
France > CIRAD: Joint Research Units: ART-DEV, SELMET, INNOVATION, TETIS; Internal Research Units: AIDA, BioWooEB, BSEF, GREEN.

CAN YOU TELL US ABOUT YOUR PARTNERSHIP WITH CIRAD?

Joice Ferreira. When I arrived in 2006, the partnership had already been up and running for a long time, since our research operations are entirely compatible. EMBRAPA is a major organization with a staff of more than 500 at our Belém centre, and we are working to tackle vast issues. With CIRAD, we share one important objective: to contribute to sustainable rural development in Amazonia while preserving social equity, conserving the forest and ensuring outlets for local producers. We are working together in several fields, but I would like to stress three topics in particular on which we are working very closely together: environmental services, forest management and territorial development.

WHAT ARE YOUR CURRENT PROJECTS?

J.F. There are two main projects. ECOTERA* (Eco-efficiency and territorial development in Brazilian Amazonia) is a research-development project at Paragominas, the first green Municipe in Amazonia. TMFO** (Tropical Managed Forest Observatory) is a pantropical network associating Amazonia (Brazil, French Guiana, Guyana, Surinam, Bolivia and Peru) looking at the resilience of tropical managed forests. Within the RAS Sustainable Amazon Network, which I am coordinating, we are studying the ecological and social impacts of deforestation and forest degradation. We have also co-organized several scientific events and training courses. We are currently co-organizing a seminar on forest degradation, to be held in Belém in April 2015. Researchers and decision-makers will be meeting to discuss the major threats facing the Amazonian forest, which current policies do not necessarily take into account.

WHAT ADDED VALUE DOES CIRAD PROVIDE?

J.F. Our two organizations have very complementary expertise, which helps us strengthen our research teams. We really benefit from sharing our experience. Our organizations, which are both deeply committed to boosting the impact of their research through a network of scientists, particularly the Federal University of Para, work in synergy. Our partnership is a great success. In the short and long term, it holds great promise for both parties.

* Coordinated by Marie-Gabrielle Piketty, UPR GREEN, Management of Renewable Resources and Environment.

** Coordinated by Plinio Sist, UPR BSEF, Tropical Forest Goods and Ecosystem Services.

SOCIETIES, NATURE AND TERRITORIES

Overcoming vulnerability

THE RESILIENCE OF SOCIO-ECOSYSTEMS

© E. Bru/CIRAD

How, within its environment, does a society handle disruption and react to it? To answer this question, which is of growing concern in an ever-changing world, an interdisciplinary scientific community, of which CIRAD is a member, has been built up over the past decade or so, centring on the "resilience of socio-ecosystems" (Resilience Alliance). More recently, the concept has been widely taken on board with a view to finding solutions to the various recurrent crises affecting the world's poorest countries.

Interview with Aurélie Botta, ecologist at CIRAD

What exactly is the resilience of societies within their environment?

Aurélie Botta. The aim is to determine how a society within its environment - a socio-ecosystem - handles disruption, in other words how it prepares for and reacts to it in the short, medium and long term. Initially, the concept of resilience was developed within the physical science field, and referred to the capacity of a material to recover its initial properties after trauma (chemical, mechanical or other). In the 1960s, psychiatrists and psychoanalysts, such as Boris Cyrulnik in France applied the concept to individuals who had suffered trauma, to assess and build their capacity to rebuild their lives and live with the past. At the same time, ecologists and mathematicians were also using it to monitor the changes in ecosystems subject to disruption: forests after fires, mangrove swamps after hurricanes Socio-ecosystem resilience introduces the human aspect into ecosystems, since disruptions and response mechanisms necessarily involve society and the environment (eg food crises triggered by inappropriate international trade or adaptation through the introduction of new resource-sharing rules).

As things stand, what do we know about the resilience of socio-ecosystems?

A.B. Resilience is not necessarily a "good" thing. Addressing the resilience of a socio-ecosystem means trying to pinpoint the various options open to a society following disruption. We may try to safeguard the functioning of that socio-ecosystem even if some aspects of the environment or society are changing; this is known as adaptation. A dyke may be built to prevent flooding, for instance as a result of climate change. However, it may be better to see disruption as an opportunity to change undesirable interactions between society and the environment. In this case, disruption is an opportunity for change, as was the case with some of the excesses of the green revolution, which has prompted in-depth changes in practices and institutions that have given rise to ecologically intensive agriculture or agro-ecology.

The ability of a socio-ecosystem to adapt or transform itself depends on its ability to organize itself and learn, regardless of whether the disruption is known or new, sudden or gradual, external or internal. Lastly, in an ever more connected world, disruptions and the way in which socio-ecosystems respond to them are also interdependent in both space and time.

Is resilience and development a universal concept these days?

A.B.: The concept of resilience considers that change is not exceptional but intrinsic, and that we should not be thinking in terms of stability and balance but of steering and pathways. It is precisely in order to think about how to coordinate short-term crisis management and long-term development pathways that many players from the development sector (World Bank, FAO, CGIAR, AFD) have sized upon the resilience concept. However, resilience does not mean the same thing to everyone. Should we be targeting the poorest people or addressing the system as a whole, given the potential transfers of vulnerability? Should we focus on adaptation strategies or making drastic changes? Should we take account of the complexity of feedback and ecological thresholds? François Bousquet and I based ourselves on the principle of dialogue between the various communities and schools when coordinating the organization of the Resilience 2014 conference, so as to highlight the respective contributions of these different approaches.

Resilience2014 www.resilience2014.org

Managed forests

A global network to measure the resilience of tropical logged forests

The idea of a virgin tropical forest, untouched by man, captures the imagination of people in general and researchers in particular. Logging, which is often practised in a predatory way with no concern for the long-term maintenance of its resources and environmental services (biodiversity, carbon sequestration) often gets a bad press. However, the concept of sustainable logging is making headway among foresters and is a major issue for tropical forest preservation in the future. A global network of organizations, the Tropical managed Forests Observatory, is looking for the first time, on a regional and pan-tropical scale, at the resilience of these forests after selective logging. Its work concerns three main forest regions: the Amazon, Congo Basin, and Southeast Asia. The project is coordinated by CIRAD and funded by the CGIAR Forest Tree and Agroforestry programme, and involves twenty research organizations from sixteen countries.

http://tmfo.org/

plinio.sist@cirad.fr
(Tropical Forest Goods and Ecosystem Services - UPR BSEF)

400 million ha
of tropical forest are intended for timber production, or 10% of the world's forests

COSTA RICA

BIODIVERSITY AND ECOSYSTEM SERVICES MAKE GOOD BEDFELLOWS

bruno.locatelli@cirad.fr (Tropical Forest Goods and Ecosystem Services - UPR BSEF)

Zones identified as biodiversity hotspots can also be highly important for the provision of multiple ecosystem services, such as carbon sequestration, water conservation and landscape beauty. This is not necessarily the case for zones with large amounts of carbon, which have fewer advantages in terms of other ecosystem services. These were the conclusions drawn from a study in Costa Rica by a team from CIRAD, CIFOR and CATIE. The results could have repercussions for the choice of zones to be protected under initiatives aimed at mitigating emissions caused by deforestation, such as REDD+. Favouring regions with high biodiversity and taking account of the multiplicity of ecosystem services rendered, and also of the value of those services for people should allow planners to make better decisions as to the priority zones to be protected.

Red-eyed tree frog *(Agalychnis callidryas)* in Costa Rica © B. Locatelli/CIRAD

PARTNERS. Costa Rica > Centro Agronómico Tropical de Investigación y Enseñanza (Catie). **Indonesia >** Centre for International Forestry Research (Cifor).

Environmental Conservation, 41: 27-36.
Doi: 10.1017/S0376892913000234

TROPICAL RAINFORESTS

CLIMATE CHANGE COULD LEAD TO A DROP IN PRODUCTIVITY

bruno.herault@cirad.fr (Ecology of the Forests of French Guiana – UMR ECOFOG)

Tropical rainforests are under unprecedented threat as a result of climate change. Temperatures are rising and look set to continue to do so in the coming decades, while rainfall is likely to decrease. How do trees react to these types of disruption? What are the repercussions for their growth? And what climatic factors most affect that growth? The answers to these questions will govern the future productivity of tropical rainforests. An analysis of data gathered throughout the Tropics helped a CIRAD team to clarify the situation. It showed that tree growth was highly seasonal, and that that variability could primarily be put down to a site effect. It also demonstrated that rainfall and sunshine levels within a given ecosystem were the main factors that determined growth. As a result, tropical forest productivity could well decrease in the coming years if, as climate models are forecasting, rainfall levels drop and droughts are more frequent.

Installing a micro weather station, Réserve de la Trinité, French Guiana © B. Hérault/CIRAD

PARTNERS
Belgium > KU Leuven. **Brazil >** Instituto Nacional de Pesquisas Espaciais (INPEL). **France >** Institut national de la recherche agronomique (INRA); University of the West Indies and French Guiana. **Germany >** University of Hohenheim. **Italy >** Euro-Mediterranean Centre for Climate Change.

PLoS One, 9: e9233. Doi: 10.1371/journal.pone.0092337

Farmers and Ministry staff drafted and analysed scenarios for change in the zone © N. Faysse/CIRAD

OVER-USE OF AQUIFERS IN MOROCCO
SUPPORTING PLAYERS IN A DEBATE

nicolas.faysse@cirad.fr
(Water Management, Stakeholders and Uses - UMR G-EAU)

The market garden region of Chaouia on the Moroccan coast went through a severe economic crisis in the 1990s. The reason was the over-use of groundwater supplies and its disastrous consequences for production, and also a lack of dialogue between the authorities and farmers with a view to finding solutions. How could a debate be launched to tackle that over-use and revive production? Researchers worked to help farmers and representatives of the authorities take a joint look at the possible ways in which the territory could change. They showed that it is possible to contribute to such a debate in these zones, notably by centring the analysis on adapting to current climate variability, or by including in the debate both the matter of managing the resource and its use, and that of agricultural development. The operation looks promising, at a time when climate change will require ever greater capacity to adapt.

PARTNERS. France > Bureau de recherches géologiques et minières (BRGM); National Research Institute of Science and Technology for Environment and Agriculture (IRSTEA); Lisode. **Portugal >** University of Lisbon. **Morocco >** Cap Rural; Ecole nationale d'agriculture de Meknès; Institut agronomique et vétérinaire Hassan II.

Regional Environmental Change, 14 (suppl.): 57-70. Doi: 10.1007/s10113-012-0362-x

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TERRITORIAL MANAGEMENT OF THE ENVIRONMENT
PUTTING STAKEHOLDERS CENTRE-STAGE

francois.dumoulin@cirad.fr . **tom.wassenaar**@cirad.fr
(Recycling and Risk)

How can we design territory-scale organic waste management systems that are acceptable to all the stakeholders, whether producers or consumers of that waste? How can we reconcile the often diverging views those stakeholders have of the environment? What method should be used to assess the impact of such management systems on the environment? To answer these questions, a team from CIRAD demonstrated the necessity of taking account of stakeholders' views and developed a new representation framework based on a conception of the environment that is neither techno- nor ecocentric, but anthropocentric. The researchers developed this generic anthropocentric environmental representation framework by working at the interface between several disciplines. They are now testing its application under an integrated management project that involves using organic waste in agriculture in Réunion. To this end, they have developed a participatory environmental assessment approach and compiled indicators tailored to a broad range of stakeholders.

PARTNER. France > Agence de l'environnement et de la maîtrise de l'énergie (ADEME)

Sustainability, 6: 6267-6277. Doi: 10.3390/su609626

Participatory breeding in Mali

A cooperative to preserve and promote biodiversity

Since 2010, a project on the sustainable management of agricultural biodiversity in Mali, coordinated by CIRAD, has contributed to the development of sorghum varieties through participatory breeding and helped establish biodiversity monitoring indicators. It has also trained producers in intellectual property rights (IPR) over plant varieties. The project ended in 2014*, and led to the founding of a cooperative: GDBA-Mali**. Following on from the project, the cooperative will be stepping up collaboration between researchers and producers on varietal breeding and local processing of cereals and legumes, and ensuring that farmers' rights over their seeds are respected.

anne-marie.schelstraete@cirad.fr
(Office of the Director General in charge of Research and Strategy)

gilles.trouche@cirad.fr
(Genetic Improvement and Adaptation of Mediterranean and Tropical Plants - UMR AGAP)

* The final project scientific seminar was held on 19 and 20 March in Bamako.

** GDBA: Gestion durable de la biodiversité agricole (sustainable management of agricultural biodiversity)

Research and training platform in partnership (PP)

MULTI-INSTITUTIONAL SCIENTIFIC PARTNERSHIP AND IRRIGATION SYSTEMS IN NORTH AFRICA

The SIRMA – irrigation systems in North Africa – skills network associates some sixty researchers and teacher-researchers from organizations in Algeria, Morocco, Tunisia and France, working to save water in those irrigation systems. The platform has a triple aim: research, higher education and development support.

© A. Hammami/DR

CAN YOU TALL US A BIT ABOUT SIRMA?

Ali Hammani. SIRMA is the result of the determination of scientists in North Africa and France to launch exchanges in the field of agricultural research, particularly on water management in agriculture and irrigation systems. In 2004, the platform set up by CIRAD and its partners was given the green light by the French ministry of Foreign Affairs, with a budget of two million euros over five years. A multidisciplinary team was built around the topic of water saving in the irrigation systems of North Africa. Since then, SIRMA has become a sort of byword, and we are reaping the benefits. It has served to federate resources and is a huge asset in terms of scientific output.

WHAT ADDED VALUE IS CIRAD PROVIDING?

A.H. We work in symbiosis. CIRAD has an interesting approach to North Africa, centring on priority issues. And water use in agriculture is one of those. We can therefore compare our experience. It is acting as coordinator, and we benefit from its network. It also provides substantial support for training operations. Twenty-two PhD theses have been defended or are under way, and more than 60 students have completed Masters. This partnership has brought us national and international recognition, and the visibility we need to obtain project funding.

ANY PLANS FOR NEW PROJECTS?

A.H.: For me, the main thing is to continue to move forward together. In more concrete terms, we have plans for joint R&D and higher education operations and are always on the lookout for new projects that will sustain our collaboration in future. Eventually, the aim is to build a hub of excellence in training and research on irrigation systems in North Africa.

ali.hammani@gmail.com

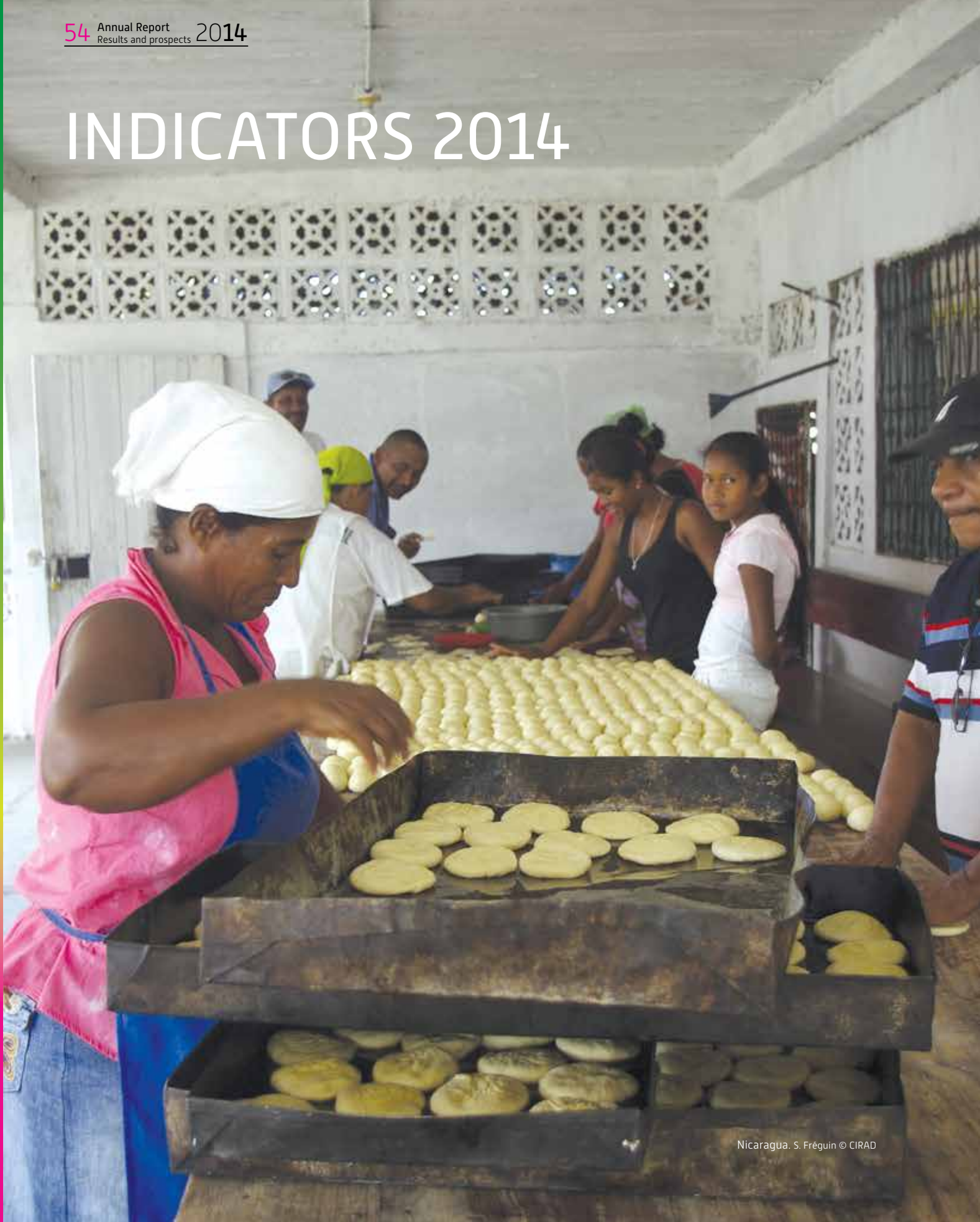
www.rcp.sirma.org

Picture painted for the SIRMA PP
© Faycel Berkat

Ali Hammani is a teacher-researcher and Head of the Water, Environment and Infrastructures Department at the Institut agronomique et vétérinaire (IAV) Hassan II in Rabat. He was a member of the Steering Committee of CIRAD's Environments and Societies Department between 2011 and 2014. Within the SIRMA network, he is scientific coordinator of the project at the IAV.

PARTNERS. **Algeria >** Centre de Recherche Scientifique et Technique sur les Régions Arides/ Mohamed Khider University, Biskra; Ecole nationale supérieure agronomique d'Alger; University of Khémis Miliana. **France >** CIRAD; Centre International de Hautes Etudes Agronomiques Méditerranéennes - Institut agronomique méditerranéen de Montpellier (CIHEAM - IAMM); Centre international d'études supérieures en sciences agronomiques (SupAgro Montpellier); Institut de recherche pour le développement (IRD); Institut des sciences et industries du vivant et de l'environnement (AgroParisTech); National Research Institute of Science and Technology for Environment and Agriculture (IRSTEA). **Morocco >** Ecole Nationale d'Agriculture de Meknès (ENAMeknès); Institut Agronomique et Vétérinaire Hassan II, Rabat (IAV Hassan II). **Tunisia >** Institut national d'agronomie de Tunis (INAT); Institut National de Recherche en Génie Rural Eaux et Forêts (INRGREF), Tunis.

INDICATORS 2014



Nicaragua. S. Fréguin © CIRAD

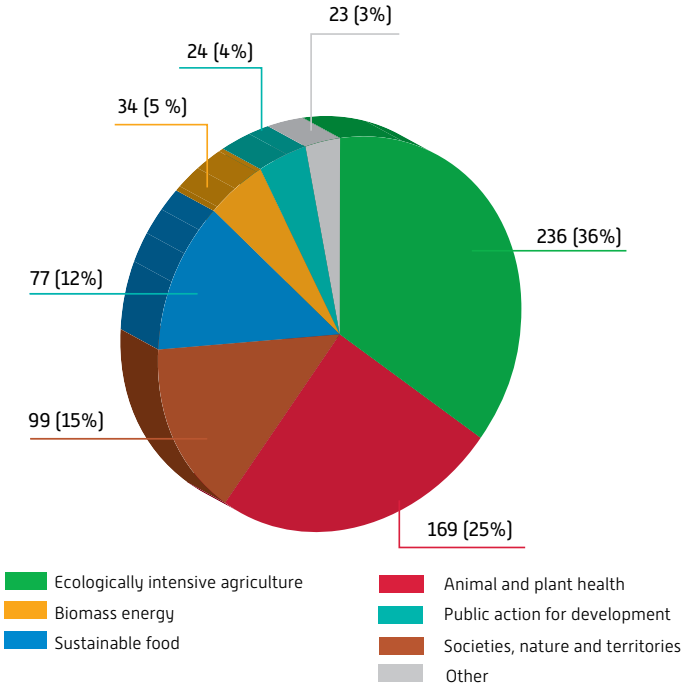
The main indicators presented in this annual report reflect CIRAD's activities and their linkages to the organisation's key ambitions. However, in order to ensure continuity in the reading of indicators, the format of data presented is the same as in previous years. While remaining consistent with the monitoring mechanism for the new CIRAD 2014-2018 Contractual Objectives, this report does not adopt the structure of these Objectives, which correspond to the four ambitions[1] expressed in the *2012-2022 Strategic Vision*[2].

> THE AMBITION OF SHARING SCIENCE TO MEET THE CHALLENGES FACING SOUTHERN COUNTRIES

As indicated in the document entitled *"Objectifs de stratégie scientifique et partenariale (OSSP) 2014-2019"*[3], mobilising research teams to work on the six updated priority lines of research and conducting capacity building initiatives in southern countries are central to CIRAD's ambitions.

In 2014, CIRAD continued its efforts to produce high-quality scientific output with the publication of articles in peer-reviewed journals on subjects in line with the organisation's scientific priorities as well as exploring new research areas. Most of CIRAD's publications are referenced in research lines as shown in the figure below. Peer-reviewed journal articles are primarily divided between Ecologically intensive agriculture (36%) and Animal and plant health (25%).

Distribution by line of research of peer-reviewed articles, with or without impact factor[3]



Source Agritrop. Dist- DGD-RS- The 2014 data are partial: they reflect the state of the Agritrop database as of 28 February 2015.

The increase in the number of co-publications with at least one author from the South between 2010 and 2014 (from 328 to 391) reflects CIRAD's desire to develop a balanced and sustainable partnership with its scientific partners in southern countries. These co-publications made up the majority (51%) of all publications in 2014.

After falling in 2013 (-12.8%) partly due to the mobilisation required by the series of AERES appraisals in all research units, the number of PhD students from southern countries supervised by CIRAD grew significantly (+26%) in 2014[4].

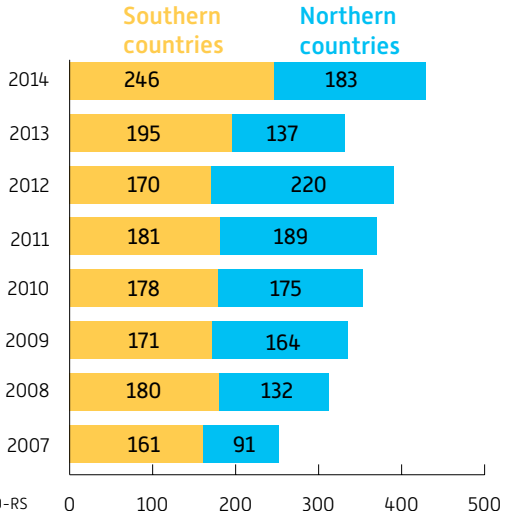
Co-publications with operators in southern countries

* A country is classified as a southern country if it is on the OECD/DAC list of official development assistance recipient countries.

Peer-reviewed journal articles, with or without impact factor *Data smoothed over three years*	2010	2011	2012	2013	2014*
Articles published with at least one southern author	328	352	382	413	391
Total number of peer-reviewed articles	**708**	**725**	**773**	**811**	**774**

Source Agritrop. Dist- DGD-RS- The 2014 data are partial: they reflect the state of the Agritrop database as of 28 February 2015. * 2014: provisional data

Supervision of PhD students by CIRAD researchers



Source: DGD-RS

1. Ambition 1. Serving as a global reference in terms of our scientific priorities. Ambition 2. Co-constructing strategic agricultural research for development partnerships. Ambition 3. Establishing the conditions for effective innovation. Ambition 4. Changing in order to measure up to our ambitions.

2. http://www.cirad.fr/en/who-are-we/our-strategy

3. Further to the redefinition of lines of research from 2014, only publication data for 2014 can be given.

4. Moreover, the processing of data from different sources within the PhD student supervision system has been improved.

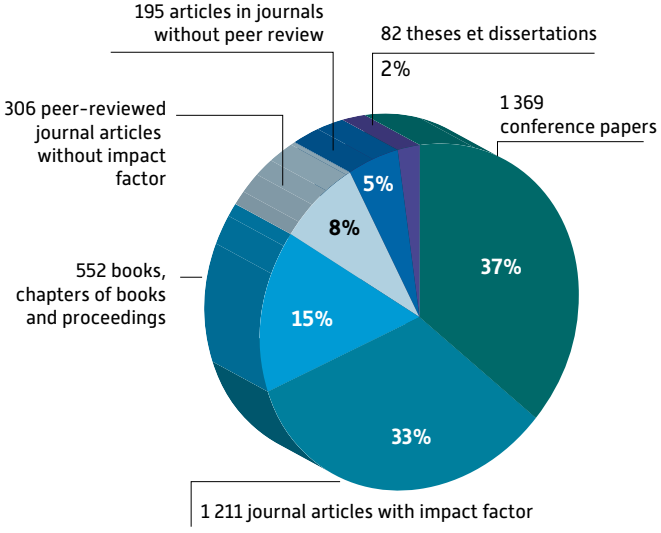
> DIVERSIFIED, HIGH-QUALITY SCIENTIFIC OUTPUT

In order to ensure that science for development attains the highest international scientific level and yet remains relevant to the issues, areas and partnerships specific to southern countries, CIRAD is striving to improve the quality of its scientific publications and the competitiveness of its teams. At the same time, it is ensuring the diversity of its outputs, which are aimed at different audiences.

For the 2013-2014 period, articles published in impact factor journals (1 211, or 33%) and conference papers (1 369, or 37% of all publications) account for the majority of publications.

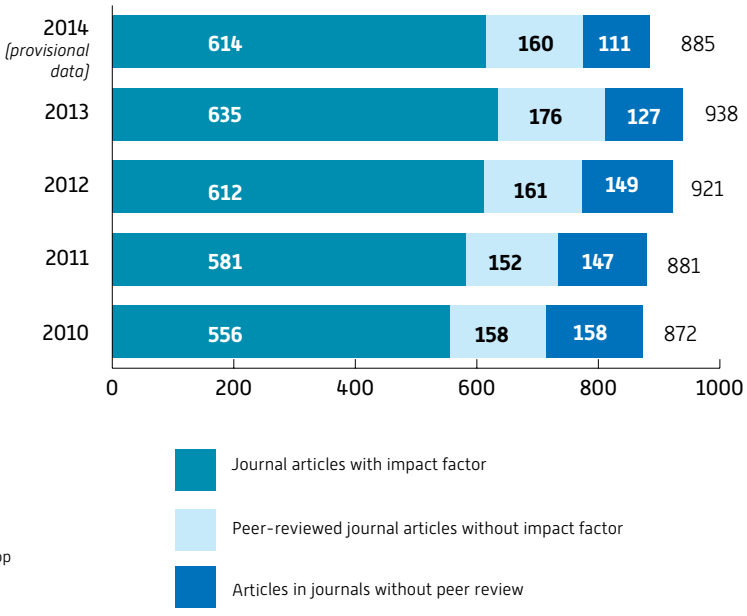
After growing for several years, the number of peer-reviewed journal articles, with or without impact factor, has been stable for the last two years. Similarly, after a period of considerable growth, the number of directors of research has been stable for the last two years. Outreach activities are also stable. Growth in the last few years has concerned the shift towards co-deposits with industrial or public partners, which contributes to strengthening CIRAD's networks and sharing the financial risks associated with these activities.

Distribution, by document type, of CIRAD's publications for the 2013-2014 period



Source Agritrop. Dist- DGD-RS- The 2014 data are partial: they reflect the state of the Agritrop database as of 28 February 2015.

Change in the number of journal articles between 2010 and 2014



Research training for CIRAD's senior scientific staff

Number of research directors at CIRAD

2009	2010	2011	2012	2013	2014
107	129	136	143	166	162

Source: SIRH, DGD-RD

Outreach: patents, proprietary variety protection certificates and software programmes

Number of applications for patents, proprietary variety protection certificates and software programmes
(in brackets: number of patents attributed)

2008	2009	2010	2011	2012	2013	2014
13 *(0)*	26 *(4)*	10 *(5)*	8 *(2)*	8 *(3)*	9 *(0)*	8 *(3)*

Source: DelValo, DGD-RS

> NATIONAL AGRICULTURAL RESEARCH OPEN TO EUROPE AND THE REST OF THE WORLD

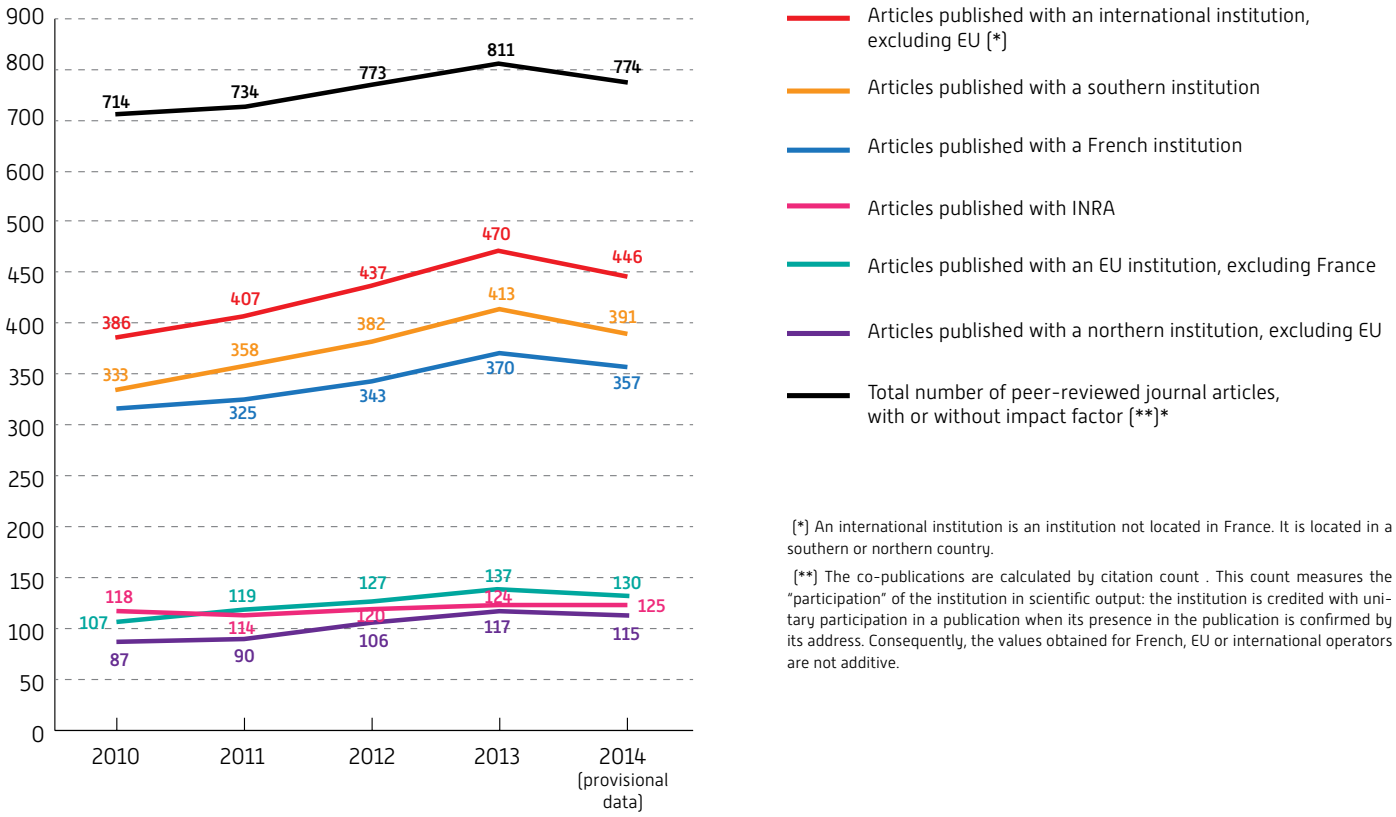
CIRAD's activities continued in 2014 on different levels: at the French regional level, particularly through the implementation of site policies; at the national level, especially through its collaboration with INRA for scientific and international cooperation issues, as well as with other French research and training organisations for environmental and agricultural issues within the framework of the AllEnvi alliance and the national Agreenium consortium; at the European level with key initiatives (IntensAfrica) to structure research and development operators; and at the international level, with a special focus on the 21 research platforms in partnership (RPPs) and the consolidation of initiatives undertaken with the Consultative Group on International Agricultural Research (CGIAR).

The number of CIRAD co-publications with other institutions continues to grow. More than half (58%) of peer-reviewed journal articles, with or without impact factor, are co-published with an international institution, illustrating the priority given to southern countries, Europe and international operations.

The geographical mobility of CIRAD staff members was broadly stable in 2013-2014, as was the number of senior scientific staff members posted in the research platforms in partnership (RPPs) and in the French overseas departments, after a significant increase in the RPPs between 2012 and 2013. Of the 21 RPPs, 11 are located in Africa (including one RPP based in the French overseas departments), 5 in Latin America, 4 in Asia, and 1 in the Mediterranean. There has been a slight drop in the number of overseas assignments, with the main destination remaining sub-Saharan Africa.

In the specific context of the first year of implementation of the new H2020 programme, in 2014 CIRAD's success rate for FP7 calls for proposals was low. However, CIRAD is increasing its mobilisation for other types of European funding, such as DG Development and Cooperation (DevCo) instruments, where the role of agricultural research is increasingly recognised.

Change in number of CIRAD co-publications between 2010 and 2014

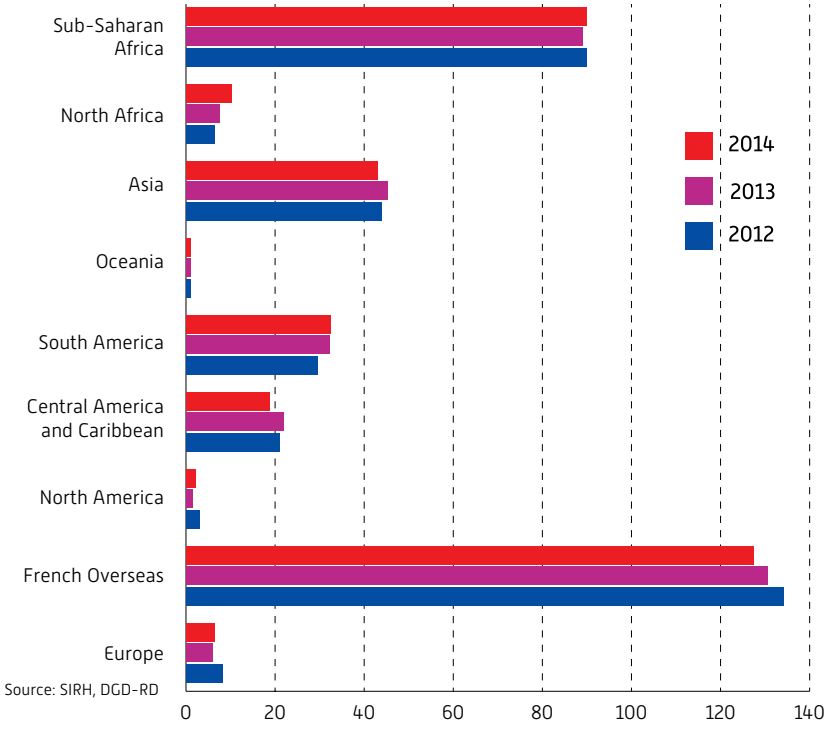


(*) An international institution is an institution not located in France. It is located in a southern or northern country.

(**) The co-publications are calculated by citation count . This count measures the "participation" of the institution in scientific output: the institution is credited with unitary participation in a publication when its presence in the publication is confirmed by its address. Consequently, the values obtained for French, EU or international operators are not additive.

Source Agritrop. Dist- DGD-RS- The 2014 data are partial: they reflect the state of the Agritrop database as of 28 February 2015.

Distribution of overseas postings, according to destination (full-time equivalent)



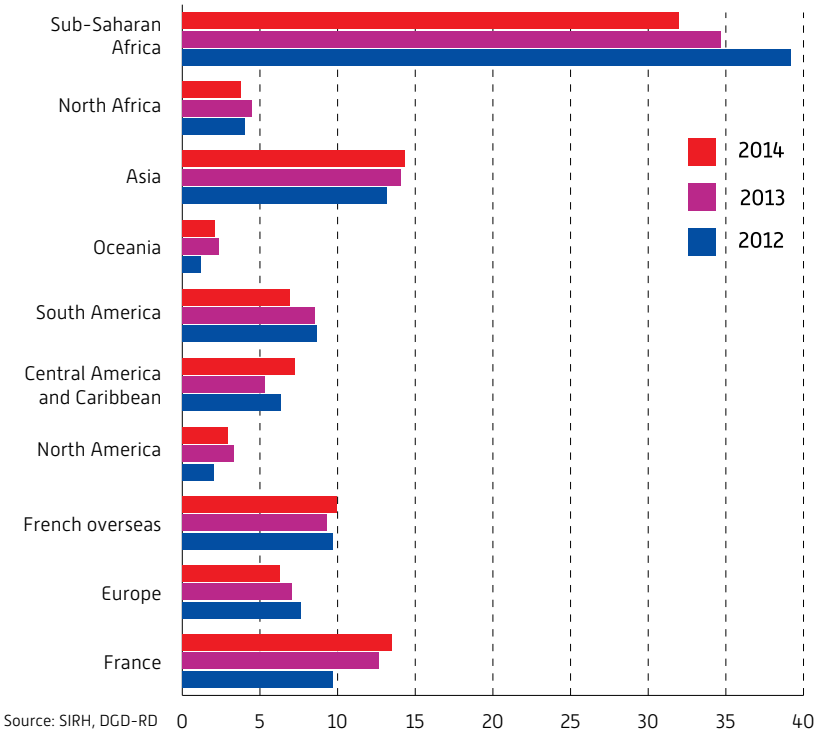
Source: SIRH, DGD-RD

Number of senior scientific staff members (CS) assigned to research platforms in partnership (RPPs) and in French overseas postings

	2012	2013	2014
Number of CS posted overseas	302	304	302
Number of CS in RPPs overseas	94	130	129
Number of CS in French overseas departments	113	113	114

Source: SIRH, DGD-RD

Distribution of assignments according to destination (% full-time equivalent)



Source: SIRH, DGD-RD

Table of research platforms in partnership (RPPs)

Region	National RPPs	Regional RPPs
AFRICA		
	PPZS - Senegal- Lines 1, 5, 6	ASAP - West Africa - Lines 1, 4, 6
	RP-PCP - Zimbabwe - Lines 1, 4, 6	DPFAC - Afrique centrale - Lines 1, 6
	CRDPI - Congo - Lines 1, 6	SISTO - West Africa - Lines 3, 5, 6
	Forest & Biodiversity - Madagascar - Lines 2, 5, 6	DIVECOSYS- West Africa - Line 1
	PCP Agroforestry - Cameroon - Lines 1, 5, 6	
	PP & G - South Africa - Lines 5, 6	
	SPAD - Madagascar - Lines 1, 6	
ASIA		
	HRPP - Thailand - Lines 1, 6	CANSEA - Southeast Asia - Lines 1,6
	MALICA - Vietnam - Lines 3, 5	GREASE - Southeast Asia - Line 4
LATIN AMERICA		
	PCPAFS-PC - Costa Rica - Lines 1, 5, 6	AMAZONIE - Bassin amazonien - Line 6
	CIBA - Brazil - Line 1	PP -AL -Latin America (10 countries) - Lines 5, 6
		RéSA-CaribVET - Guadeloupe-Caribbean - Line 4
MEDITERRANEAN		
		SIRMA - North Africa - Lines 1, 5, 6

Source: Partnerships Office, DGDRS

CIRAD's EU research and development projects (FP) between 2010 and 2014

	2010	2011	2012	2013	2014
Number of projects submitted	18	21	20	24	24
Number of projects funded	7	5	8	7	3
Success rate (%)	39	24	40	29	13
Number of projects coordinated by CIRAD	2	3	0	3	0

Source: Europe Office, DGD-RS

> A STRUCTURE AND RESOURCES ADJUSTED TO MEET NEW CHALLENGES

In 2014, the organisation laid the foundations for a multi-year plan, the Resource Development Pact, aimed at consolidating CIRAD's economic model through targeted actions to optimise its portfolio of contractual resources.

The strong mobilisation of research teams in 2014 enabled CIRAD to increase its own resources. The indicators show greater profitability of contractual activity after a period of decline, especially with an increase in European funds (structural funds and R&D funds). However, in a context of continued constraint, the policy to control expenditure was maintained in 2014.

Despite a notable shift in CIRAD's employment policy, with employment being a priority for the organisation, the number of people employed by CIRAD continued to decline in 2014.

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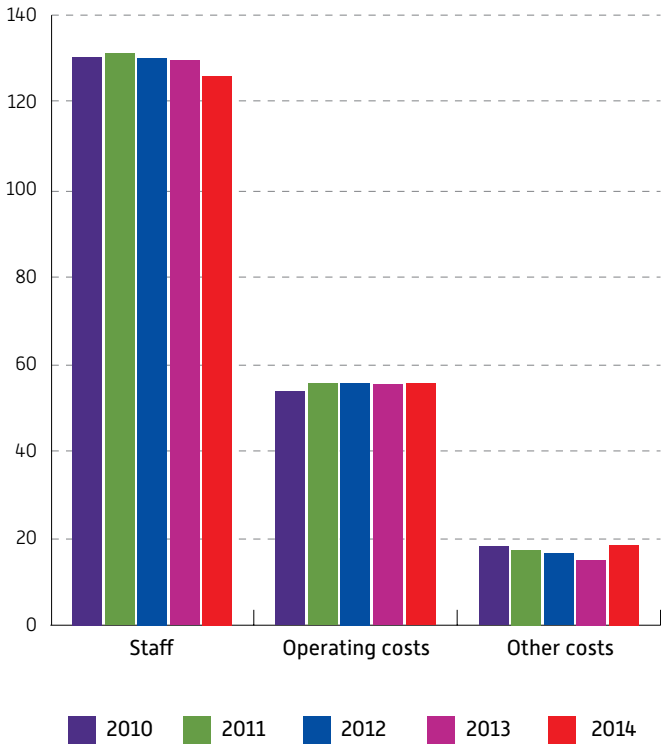
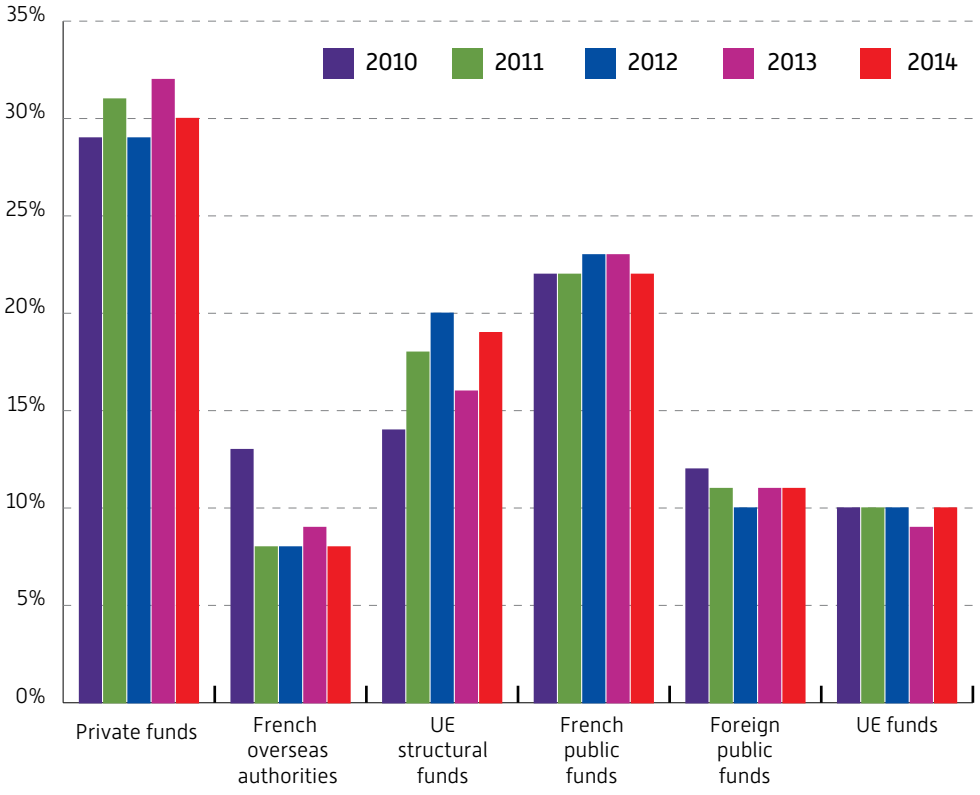
Operating costs, excluding internal subcontracting 2010-2014, in million euros



Source: DCAF, DGD-RD
(see *Rapport de gestion*, in French only)

Resources generated by CIRAD: amount and annual breakdown as a percentage (excluding joint contracts)



Source: Dcaf, DGD-RD (cf. « Rapport de gestion »)

Total number of CIRAD staff members (full-time equivalent)

	2009	2010	2011	2012	2013	2014
Number of "classified paid" permanent contracts	1764	1752	1739	1717	1681	1635
Number of grant-funded PhD students	71	83	81	72.6	73.6	64

Source: SIRH-DGD-RD

Annual breakdown of "classified paid" jobs per category (including grant-funded research students with CIRAD contracts), as a percentage

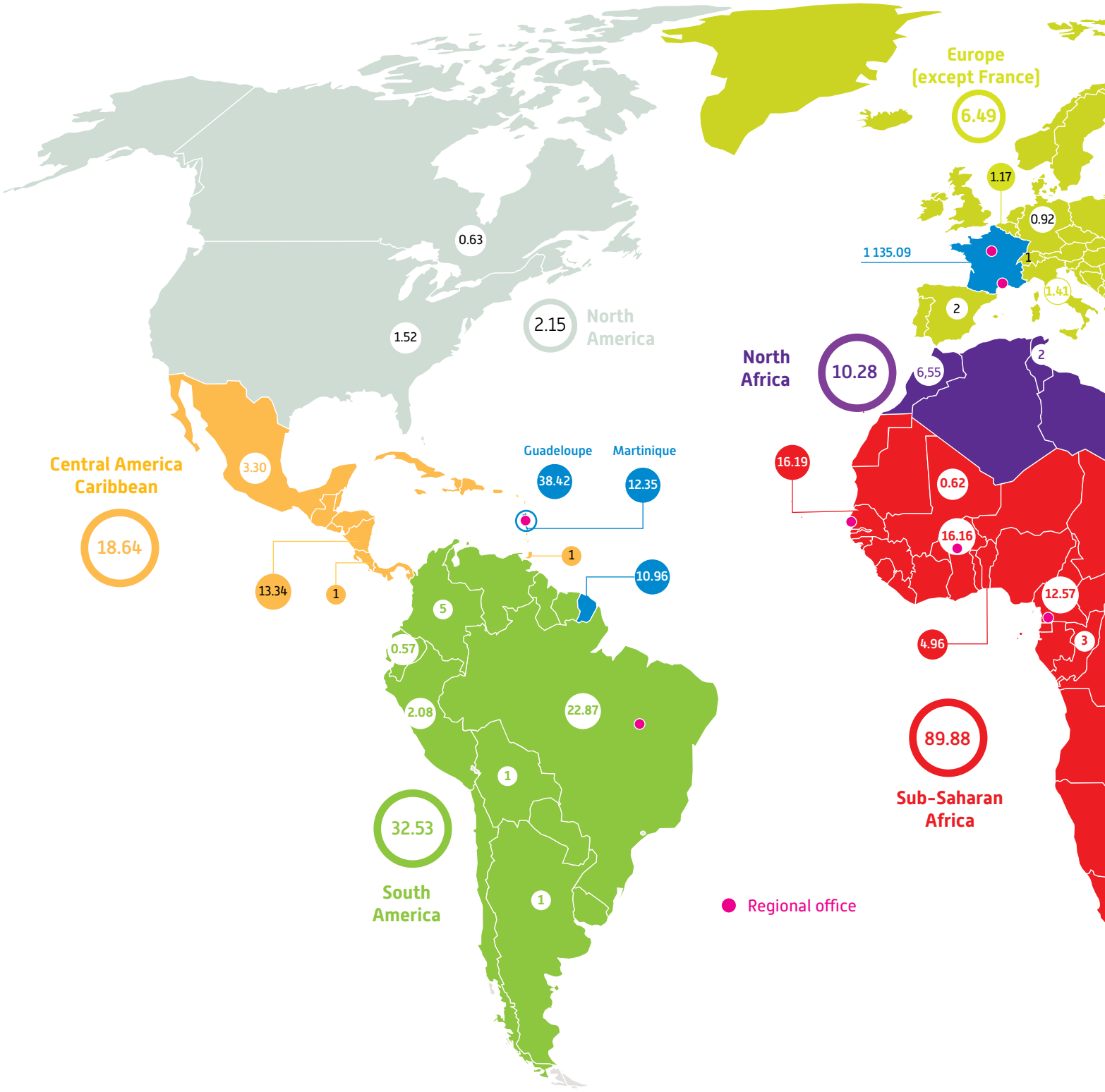
	2009	2010	2011	2012	2013	2014
Senior staff	59.2	59.6	60.6	62	62.9	64.1
Grant-funded PhD students	3.9	4.6	4.5	4.1	4.2	3.8
White-collar staff	31.4	31.5	31.6	31.5	31	30.6
Ancillary staff	5.5	4.4	3.4	2.4	1.8	1.5

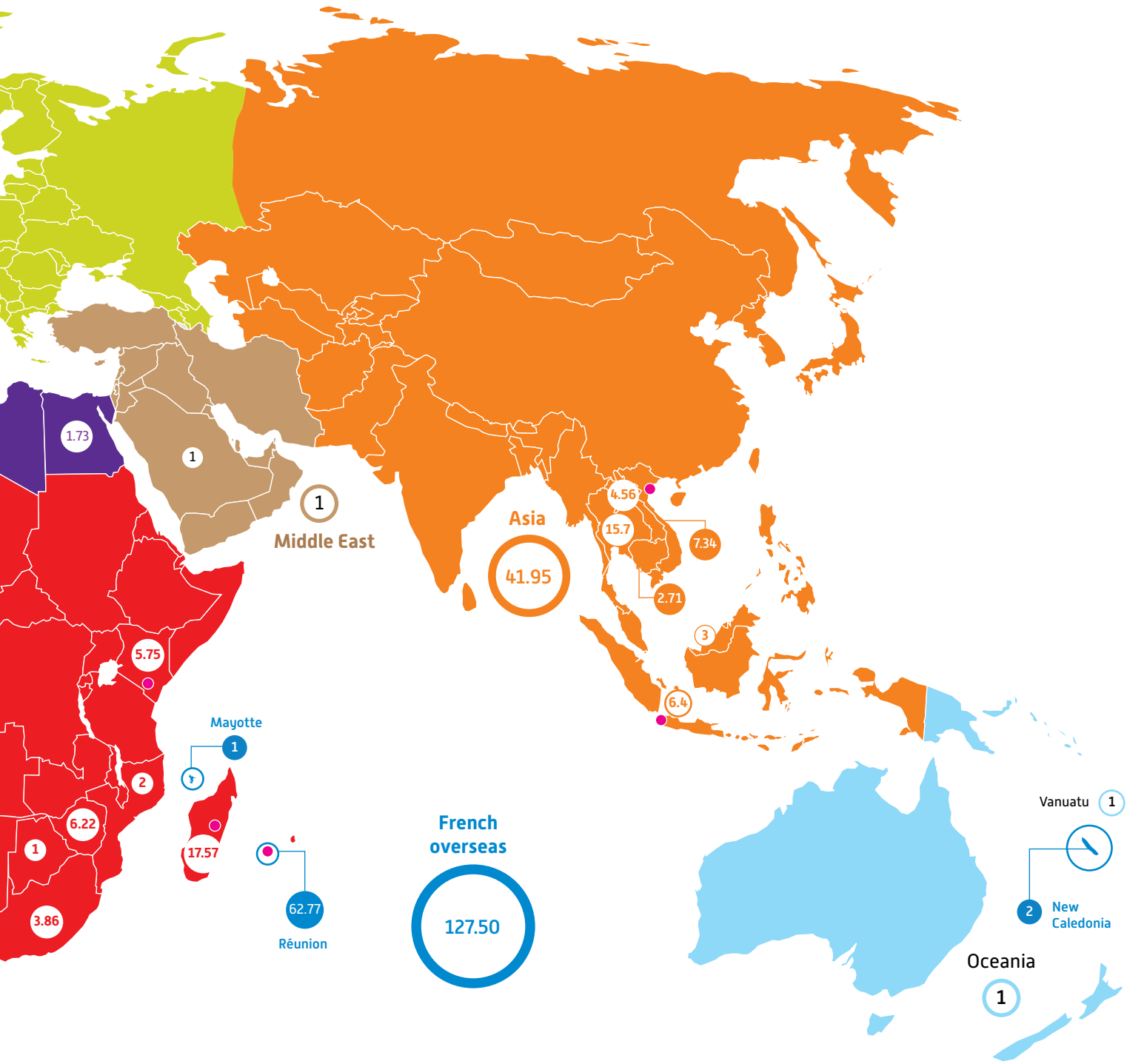
Source: SIRH-DGD-RD

ORGANIZATION ADDRESSES

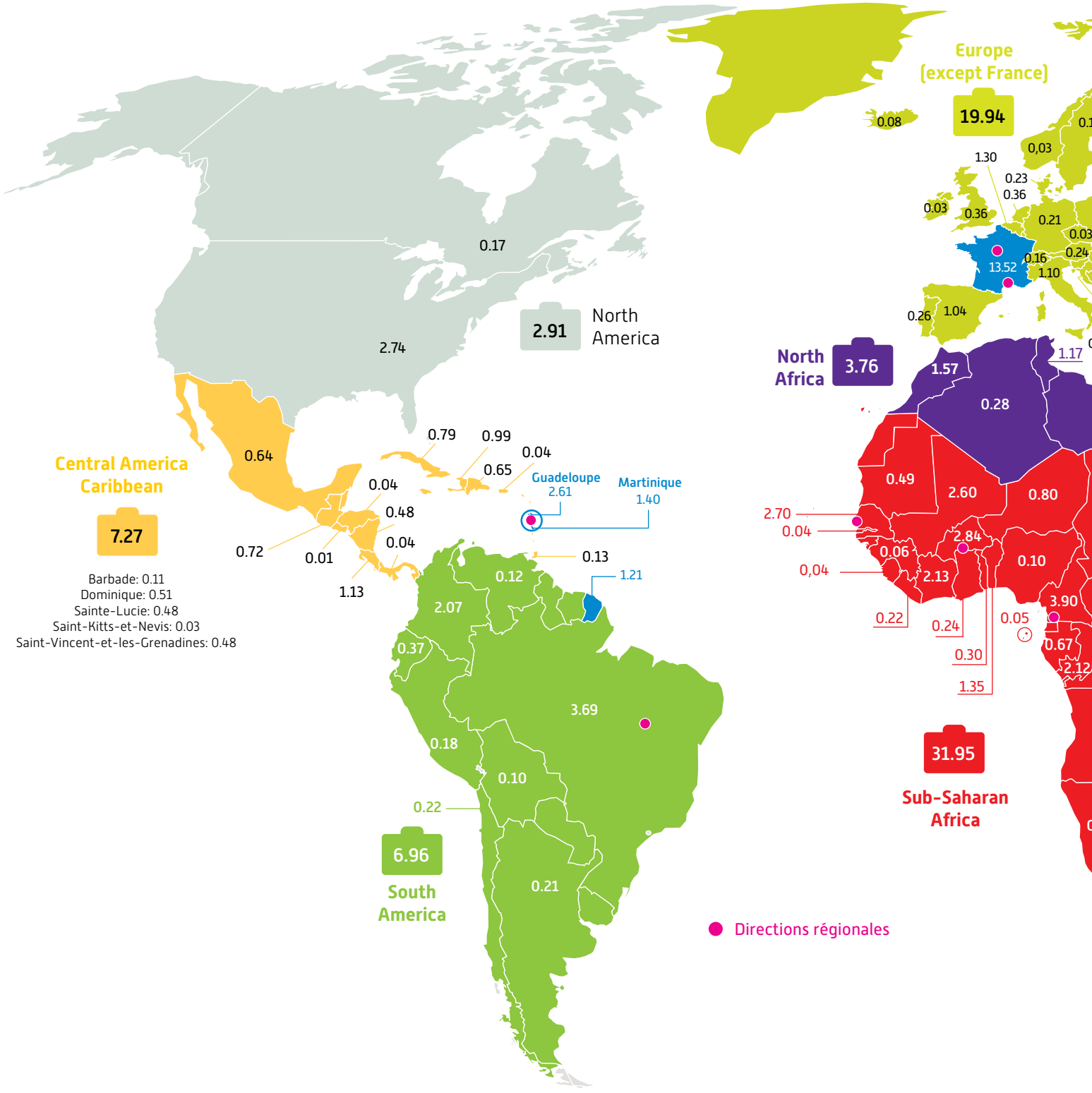
Fetching water in the Omo Valley, Ethiopia
B. Faye © CIRAD

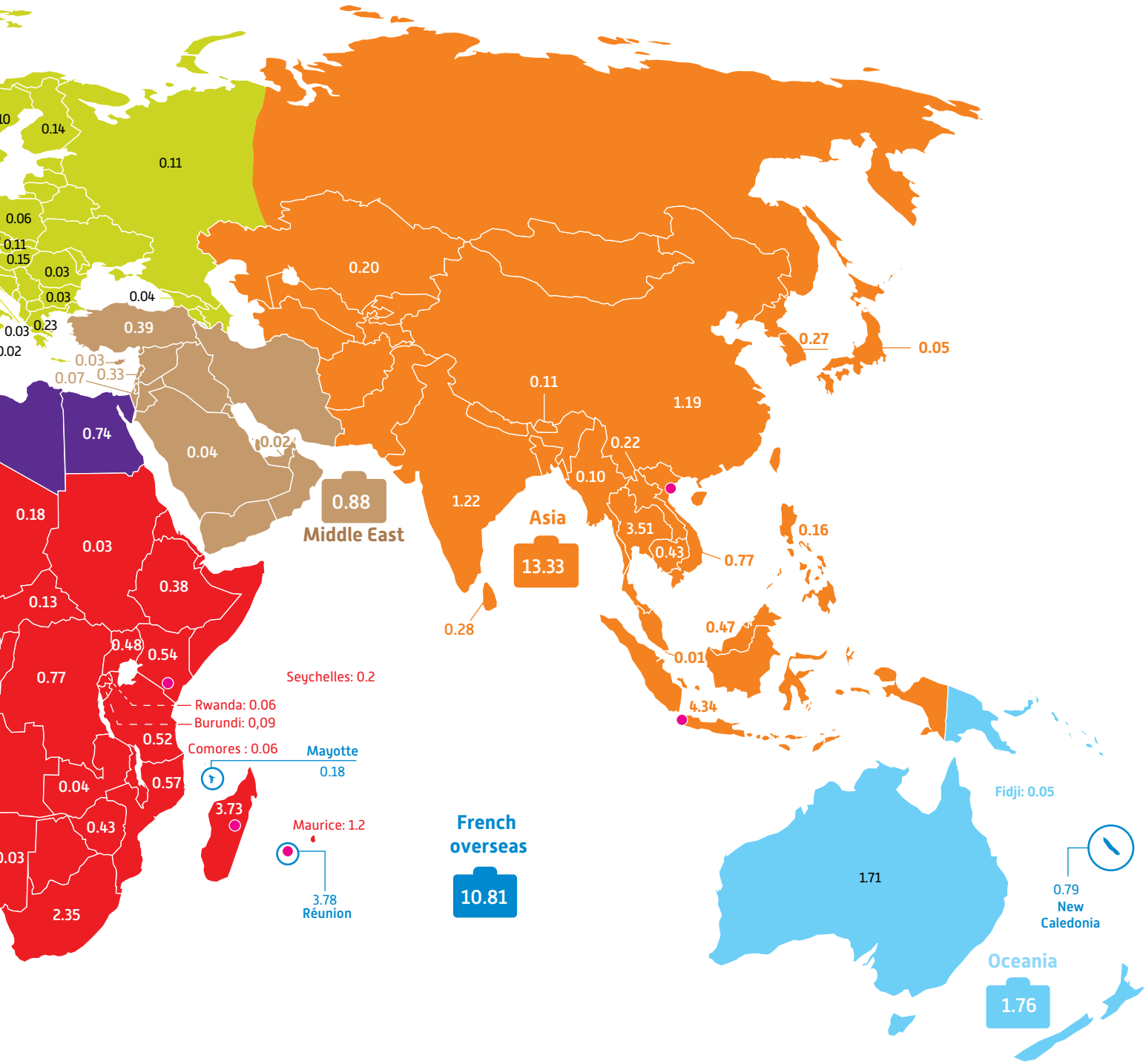
Permanent CIRAD staff numbers worldwide in 2014
(full-time equivalent)




1.73
1
1
Middle East
Asia
41.95
4.56
15.7
7.34
2.71
3
6.4
5.75
Mayotte
1
2
6.22
1
17.57
3.86
62.77
Réunion
French overseas
127.50
Vanuatu
1
2
New Caledonia
Oceania
1

Missions by CIRAD staff members worldwide
(full-time equivalent)




0.14
0.11
0.06
0.11
0.15
0.03
0.03
0.04
0.03
0.23
0.02
0.39
0.03
0.07
0.33
0.74
0.04
0.02
0.88
Middle East
0.20
0.27
0.05
0.11
1.19
0.22
0.10
1.22
Asia
13.33
3.51
0.43
0.77
0.16
0.28
0.47
0.01
4.34
0.18
0.03
0.38
0.13
0.48
0.54
0.77
Seychelles: 0.2
Rwanda: 0.06
Burundi: 0,09
0.52
Comores : 0.06
Mayotte
0.18
0.04
0.57
3.73
0.43
0.03
2.35
Maurice: 1.2
3.78
Réunion
French
overseas
10.81
Fidji: 0.05
1.71
0.79
New
Caledonia
Oceania
1.76

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Paul Clavier, philosopher, Ecole normale supérieure

Soraya Duboc, Agrifood Scientist, Nestlé France

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Brigitte Nesius, Deputy Manager, Accounts and Finance, Decentralised accounting and financial services

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Elisabeth Subirats, Deputy Manager, Human Resources

Joël Sor, Manager, Information Systems

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Hubert Omont, Coordinator, Tropical Supply Chains

Gilles Saint Martin, Coordinator, Strategic Operations

Biological Systems Department (BIOS)

Daniel Barthélémy, director

Dominique Berry, deputy director

Jean-Louis Noyer, associate director

Research units*

Biology and Genetics of Plant-Pathogen Interactions (UMR BGPI: INRA, Montpellier SupAgro),
Claire Neema (Montpellier SupAgro)

Botany and Computational Plant Architecture (UMR AMAP: CNRS, University of Montpellier II, INRA, IRD),
Thierry Fourcaud

Centre for Biology and Management of Populations (UMR CBGP: INRA, IRD, Montpellier SupAgro),
Flavie Vanlerberghe (INRA)

Crop Diversity and Adaptation and Development (UMR DIADE: IRD, Montpellier SupAgro, INRA, University of Montpellier II),
Alain Ghesquière (IRD)

Emerging and Exotic Animal Disease Control (UMR CMAEE: INRA),
Thierry Lefrançois

Genetic Improvement and Adaptation of Mediterranean and Tropical Plants (UMR AGAP: INRA, Montpellier SupAgro),
Patrick This (INRA)

Host-Vector-Parasite Interactions in Infections by Trypanosomatidae (UMR InterTryp: IRD),
Philippe Solano (IRD)

Laboratory of Tropical and Mediterranean Symbioses (UMR LSTM: University of Montpellier II, INRA, IRD, Montpellier SupAgro),
Robin Duponnois (IRD)

Pests and Diseases: Risk Analysis and Control (UPR),
Christian Cilas

Plant Communities and Biological Invaders in Tropical Environments (UMR PVBMT: University of Réunion),
Bernard Reynaud

Performance of Tropical Production and Processing Systems Department (PERSYST)

François-Xavier Côte, director

Hervé Saint Macary, deputy director

Nadine Zakhia-Rozis, associate director

Research units*

Agro-ecological Functioning and Performances of Horticultural Cropping Systems (UPR),
Eric Malézieux

Agro-ecology and Sustainable Intensification of Annual Crops (UPR),
Eric Scopel

Agropolymer Engineering and Emerging Technologies (UMR IATE: University of Montpellier II, INRA, Montpellier SupAgro),
Hugo de Vries (INRA)

Banana, Plantain and Pineapple Cropping Systems (UPR),
Jean-Michel Risède

Biomass, Wood, Energy, Bioproducts (UPR), Rémy Marchal

Functional Ecology and Biochemistry of Soils and Agroecosystems (UMR Eco&Sols: IRD, Montpellier SupAgro, INRA),
Jean-Luc Chotte (IRD)

Integrated Approach to Food Quality (UMR QUALISUD: Universities of Montpellier I and II, Montpellier SupAgro),
Antoine Collignan (Montpellier SupAgro)

Integrated and Ecological Intensification for Sustainable Fish Farming (UMR INTREPID: IFREMER),
Béatrice Chatain (Ifremer)

Performance of Tree Crop-Based Systems (UPR),
Eric Gohet

Recycling and risks (UPR),
Jean-Marie Paillat

Tropical and Mediterranean Cropping System Functioning and Management (UMR SYSTEM: INRA, Montpellier SupAgro),
Christian Gary (INRA)

Water, Soil and Plant Analysis (US),
Daniel Babre

Environment and Societies Department (ES)

Alain Billand, director

Sylvain Perret, deputy director

Pascal Bonnet, associate director

Hubert Devautour, associate director

Research units*

Actors, Resources and Territories in Development (UMR ART-Dev: University of Montpellier III, CNRS),
David Giband (University of Montpellier III)

Animal and Integrated Risk Management (UPR),
François Roger

Centre for International Research on Environment and Development (UMR CIRED: CNRS, EHESS, AgroParisTech, École des Ponts-ParisTech),
Franck Lecocq (AgroParisTech)

Ecology of the Forests of French Guiana (UMR ECOFOG: AgroParisTech, INRA, CNRS, University of the French Antilles and Guyana),
Eric Marcon (AgroParisTech)

Innovation and Development in Agriculture and the Agrifood Sector (UMR Innovation: INRA, Montpellier SupAgro),
Christophe Soulard (INRA)

Management of Renewable Resources and Environment (UPR),
Martine Antona

Markets, Organizations, Institutions and Operators' Strategies (UMR MOISA: CIHEAM-IAMM, INRA, Montpellier SupAgro),
Paule Moustier

Mediterranean and Tropical Livestock Systems (UMR SELMET: Montpellier SupAgro, INRA),
Alexandre Ickowicz

Spatial Information and Analysis for Territories and Ecosystems (UMR TETIS: IRSTEA, AgroParisTech),
Jean-Philippe Tonneau

Tropical Forest Goods and Ecosystem Services (UPR),
Plinio Sist

Water Management, Stakeholders and Uses (UMR G-EAU: IRSTEA, AgroParisTech, IAMM, IRD, Montpellier SupAgro),
Olivier Barreteau (Irstea)

* UMR: Joint research unit

UPR: Internal research unit

Addresses

France

Ile-de-France
André Nau,
Regional Director
42, rue Scheffer
75116 Paris
Tel.: +33 1 53 70 20 21
andre.nau@cirad.fr

Languedoc-Roussillon
Michel Salas,
Regional Director
Avenue Agropolis
34398 Montpellier Cedex 5
Tel.: +33 4 67 61 58 01
michel.salas@cirad.fr

West Indies-French Guiana
Dominique Martinez,
Regional Director
Station de Neufchâteau,
Sainte-Marie
97130 Capesterre-Belle-Eau,
Guadeloupe
Tel.: +590 5 90 86 17 90 /
+06 94 45 10 22
dominique.martinez@cirad.fr

Jean-Marc Thévenin,
Correspondent
BP 701, avenue de France
97387 Kourou Cedex,
French Guiana
Tel.: +594 5 94 32 73 52
jean-marc.thevenin@cirad.fr

Christian Chabrier,
Correspondent
BP 214
97285 Le Lamentin Cedex 2, Martinique
Tel.: +596 5 96 42 30 44
christian.chabrier@cirad.fr

Réunion-Mayotte
Regional Director
Station de La Bretagne, BP 20
97408 Saint-Denis Messageries Cedex 9
Réunion
Tel.: +262 2 62 52 81 00 /
+262 6 92 76 30 69
gilles.mandret@cirad.fr

Other locations
Yann Froelicher,
Correspondent
Centre Inra/Cirad
San Giuliano
20230 San Nicolao, France
Tél : +33 4 95 59 59 11 /
+33 4 95 59 59 59
yann.froelicher@cirad.fr

Laurent Maggia,
Correspondent
Centre IRD de Nouméa, BP 19239
98857 Nouméa Sud
New Caledonia
Tel.: +687 26 08 06
laurent.maggia@cirad.fr

Africa

Central Africa
Patrice de Vernou,
Regional Director
Rue J. Elig Essono Balla
BP 2572
Yaoundé, Cameroon
Tel.: +237 22 21 25 41
patrice.de_vernou@cirad.fr

Philippe Vigneron,
Correspondent, Congo
BP 1291
Pointe-Noire,
Republic of Congo
Tel.: +242 5 356 35 65
philippe.vigneron@cirad.fr

East and Southern Africa
Jacques Lançon,
Regional Director
C/o Icraf, United Nations Avenue
Gigiri, PO Box 30677
00100 Nairobi, Kenya
Tel.: +254 20 722 46 53
jacques.lancon@cirad.fr

Mathieu Bourgarel,
Correspondent, Zimbabwe
Cirad-Agirs
PO Box 1378
Harare, Zimbabwe
Tel.: +263 775 131 601
mathieu.bourgarel@cirad.fr

Continental West Africa
Patrice Grimaud,
Regional Director
01 BP 596
Ouagadougou 01, Burkina Faso
Tel.: +226 50 30 70 70
patrice.grimaud@cirad.fr

Philippe Menozzi,
Correspondent, Benin
Cirad/IRD
08 BP 841
31326 Cotonou, Benin
Tel.: +229 96 72 53 57
philippe.menozzi@cirad.f

Coastal West Africa
Denis Depommier,
Regional Director
37, avenue Jean XXIII
BP 6189
Dakar-Etoile, Senegal
Tel.: +221 33 822 44 84
denis.depommier@cirad.fr

Madagascar
Pascal Danthu,
Regional Director
Ampandrianomby, BP 853
Antananarivo, Madagascar
Tel.: +261 32 07 411 10
pascal.danthu@cirad.fr

Americas

Central America
Fabrice Vaillant,
Correspondent, Central America
CITA - Universidad de Costa Rica
2060 San José, Costa Rica
Tel.: +506 25 11 72 10
fabrice.vaillant@cirad.fr

François Boucher
Correspondent, Mexico
IICA - Calle San Francisco 1514
Colonia Tlacoquemecatl del Valle
03200 Mexico DF, Mexico
Tel.: +52 55 555 98 519
francois.boucher@cirad.fr

Guy Henry
Correspondent, Colombia, Ecuador
and Venezuela
Centro Internacional de Agricultura
Tropical
CIRAD ALCUE-KBBE Office - CIAT
KM 17 Recta Cali-Palmira, AA 6713,
Cali, Colombia
Tel.: +57 2 4450 3124
guy.henry@cirad.fr

Brazil
Bernard Mallet,
Regional Director
SHIS-QI 16, Conj. 3, Casa 6
Lago Sul 71640-230
Brasilia DF, Brazil
Tel.: +55 61 33 66 11 32
bernard.mallet@cirad.fr

Asia

Continental Southeast Asia
Philippe Girard,
Regional Director
Cirad, Office 102, Bat 2G
Cité diplomatique de Van Phuc
298 Kim Ma
Hanoi, Vietnam
Tel.: +844 3734 6775
philippe.girard@cirad.fr

Damien Jourdain,
Correspondent, Thailand
Asian Institute of Technology
P.O. Box 4
Klong Luang Pathumthani
Bangkok 12120, Thailand
Tel.: +66 8 265 70 14
damien.jourdain@cirad.fr

Southeast Asian Island Countries
Alain Rival,
Regional Director
Graha Kapital 1
Jl. Kemang Raya no. 4
Jakarta 12730, Indonésie
Tel.: +62 21 71 98 641
alain.rival@cirad.fr

China
Zheng Li,
Cirad-Inra Permanent
Representative
507 Tower A,
Fuhua Mansion 8,
Chaoyangmen North Avenue
Beijing 100027, China
Tel.: +86 10 6554 1871
zhengliinra@sohu.com

Editor: Michel Eddi, President of the Board of Trustees

Coordination: Patricia Doucet, Communication service

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